MYCOLOGIA

VOL. XXI JANUARY–FEBRUARY, 1929 NO. 1

MRS. FLORA WAMBAUGH PATTERSON

VERA K. CHARLES

(WITH TEXT FIGURE 1)

Mrs. Flora Wambaugh Patterson, for many years mycologist in the Department of Agriculture, died at the home of her son, Henry Sells Patterson, in Brooklyn, N. Y., February 5, 1928.

MRS. FLORA W. PATTERSON IN HER LABORATORY

It was Mrs. Patterson's privilege to belong to that little group of scientists constituting what was known in those early days

as the Division of Vegetable Pathology and Physiology, the nucleus from which the Bureau of Plant Industry has developed.

Mrs. Patterson was born in Columbus, Ohio, Sept. 15, 1847, and was the daughter of a Methodist minister, Rev. A. B. Wambaugh and Sarah Sells Wambaugh. She studied at Antioch College, graduating with the degree of A.B. in 1860, and later, in 1865, at Wesleyan College, Cincinnati, from which she received the degree of A.M. in 1883. She attended the University of Iowa in 1895, receiving the A.M. degree. In 1896 she was instructor in biology in a Boston private school.

Her marriage to Capt. Edwin Patterson took place Aug. 12, 1869. A few years after her marriage, Mr. Patterson was injured in a steamboat explosion from which he never recovered but lived ten years, a helpless invalid. After his death and while preparing her two sons for college Mrs. Patterson took up Biology at the State University of Iowa where her brother was a professor. There her active interest in botanical subjects may be said to have begun. In 1893 her brother was called to the Harvard Law School and Mrs. Patterson wishing to be near him and place her sons in a preparatory school decided to continue her studies at Yale University. Thinking all conditions for pursuing work at Yale had been arranged, she went there only to find the doors closed against her, women not being eligible at that time. In spite of the keen disappointment and inconvenience she persisted in her desire to continue botanical investigations, and, going to Cambridge, registered for work at Radcliffe College. There she remained for three years, 1892–1895, taking courses in botany and working as an assistant in the Gray Herbarium. Mrs. Patterson's training in Plant Pathology and herbarium methods was acquired during this period.

Mrs. Patterson took a Civil Service examination about 1895 and in 1896 was appointed Assistant Pathologist in the Department of Agriculture. She later became Mycologist in Charge of Mycological and Pathological Collections and retained that position until her retirement in 1923. Mrs. Patterson had a great respect for conscientious scientific investigations and her work was characterized by exactness and attention to details. No phase of a problem was too minor to justify her best attention

and endeavor. Her general knowledge of fungi was broad and a few groups had received her best attention. She had given particular attention to Exoascaceae, and published a paper in 1895 on this family. Her other contributions appeared as Department bulletins and a few articles in outside publications.

One of Mrs. Patterson's most prominent characteristics was her very active up-to-the-minute interest and knowledge of the trend of modern thought. Though born in the early half of the last century she had been able to bridge the early period of conservatism or intolerance of too advanced scientific thought and action and present an open mind to the examination of the modern interpretation of science and other branches of progressive thought.

Mrs. Patterson's courtesy and generosity were well known. In addition she possessed to a high degree a sympathetic nature and few appeals for help or advice, whether or not worthy, failed to receive kindly attention.

The last years were passed in reading as much as failing eyesight permitted. Her active interest in all lines of progress and pleasure in the discussion of current events as well as the very keen interest in the welfare of her friends remained until the last. One of her last spoken requests was to express her appreciation of her many friends in the Department of Agriculture with whom she had been associated so many years.

Connected with many scientific organizations, Mrs. Patterson was a Fellow of the American Association for the Advancement of Science; Member of the Botanical Society of America; National Geographic Society; Washington Botanical Society; Biological Society of Washington; American Phytopathological Society; and American Association of University Women. She was a contributor of bulletins of the U. S. Department of Agriculture, and of articles in scientific journals, and Assistant Editor of Economic Fungi, in 1895.

Mrs. Patterson is survived by her brother, Eugene Wambaugh, Professor Emeritus of Law at Harvard University.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

PUBLICATIONS OF FLORA W. PATTERSON

Species of *Taphrina* parasitic on *Populus*. Bot. Gaz. **19:** 380. 1894. (Abstract of paper read before the American Association for the Advancement of Science.) Also published in Proc. Am. Assoc. Adv. Sci. **43:** 293–294. 1895.

A study of North American parasitic Exoascaceae. Iowa Univ. Bull. Lab. Nat. Hist. **3:** 89–135, illus., 1895.

New species of fungi. Bull. Torrey Club **27:** 282–286. 1900.

Some woody fungi. Asa Gray Bull. **8:** 13–19. 1900.

A collection of economic and other fungi prepared for distribution. U. S. Dept. Agri. Bur. Pl. Ind. Bull. 8, 31 p. 1902.

Septoria spadicea Patterson & Charles in Spaulding, P. The present state of the white-pine blights. U. S. Dept. Agr. Bur. Pl. Ind. Circular 35: 4. 1909.

A fungus enemy of mushroom growing. Science n. s. **31:** 756. 1910. (Abstract of paper read before the American Phytopathological Society.)

Some fungous diseases of economic importance. I. Miscellaneous diseases. II. Pineapple rot caused by *Thielaviopsis paradoxa*. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 171, 41 p., *8 pl.*, 1910. (V. K. Charles and F. J. Veihmeyer, joint authors.)

Stemphylium Tritici sp. nov., associated with floret sterility of wheat. Bull. Torrey Club **37:** 205. 1910.

An edible smut. Phytopathology **2:** 93. 1912. (Abstract of paper read before the American Phytopathological Society.)

Mushrooms and other common fungi. U. S. Dept. Agr. Bull. 175, 64 p., *38 pl.*, 1915. (V. K. Charles, joint author.)

Diseases of roses in Mulford, F. L. Roses for the home. U. S. Dept. Agr. Farmers' Bull. 750: 34–36. 1916, revised 1921.

The occurrence of bamboo smut in America. Phytopathology **6:** 351–356, illus., 1916. (V. K. Charles, joint author.)

Some common edible and poisonous mushrooms. U. S. Dept. Agr. Farmers' Bull. 796, 24 p., illus., 1917, revised 1922. (V. K. Charles, joint author.)

A list of fungi (Ustilaginales and Uredinales) prepared for exchange. U. S. Dept. Agr. Circular 195: 1–50, 1922. (W. W. Diehl and E. K. Cash joint authors.)

Rose diseases and their prevention. Florida Fruits and Flow. **2:** 37–38. 1925. (From Farmers' Bull. 750.)

NORTH AMERICAN SPECIES OF SCLEROTINIA II.[1]—TWO SPECIES ON CAREX, S. DURIAEANA (TUL.) REHM, AND S. LONGISCLEROTIALIS N. SP.

H. H. Whetzel

(With plates 1–5 and 1 text figure)

Although a number of species of *Sclerotinia* have been recorded as occurring on *Carex* in Europe, it is interesting that heretofore none have been reported as such from North America. In 1918 the writer first collected a species of *Sclerotinia* on *Carex* growing in the water of an open swamp near McLean, N. Y. This is here described as a new species under the name *S. longisclerotialis*. A second species which is here provisionally referred to *S. Duriaeana* of Europe was collected along with the first in the spring of 1921. Both species have been repeatedly taken nearly every season since, in this and other *Carex* swamps in this region. During the spring and summer of 1925, 1926, and 1927 a careful investigation of the occurrence and life history of these two species of *Sclerotinia* was undertaken. This has been supplemented by morphological studies and by extensive culture work with these fungi on artificial media. The observations thus accumulated, while by no means complete, seem sufficient to afford a fairly accurate picture of the identity and the life history of each species.

Sclerotinia Duriaeana (Tul.) Rehm, Hedwigia **21**: 66. 1882

Before presenting the results of our studies on the American form which is here provisionally referred to *Sclerotinia Duriaeana*,

[1] The investigations upon which this paper is based were supported by a grant from the Heckscher Foundation for the Advancement of Research established by August Heckscher at Cornell University. The writer wishes to acknowledge also the assistance of Miss Cynthia Westcott, who as Heckscher Research Assistant has materially contributed to the success of these investigations. The photographs were taken by W. R. Fisher; the drawings were made by Miss Westcott.

it seems desirable to present the evidence in what appears to be an anomalous situation in respect to the application of this name to European forms.

SYNONYMY AND IDENTITY OF SCLEROTINIA DURIAEANA

The synonymy of *Sclerotinia Duriaeana* is much confused at several points. The attempt to unravel these tangles has involved an amount of time and labor out of all proportion to the number of names cited in the list below. However this work has disclosed a situation which appears to be of peculiar interest and importance. It suggests, to the writer at least, that there are two species commonly referred to *S. Duriaeana* which heretofore have not been distinguished. The most striking difference between the two forms appears to lie in the character of their microconidial sporodochia. For convenience and ease in understanding the following discussion we may designate these the **affine** and the **ambiens** forms.

The **affine** form produces, in the culms of its *Carex* hosts, microconidial sporodochia which are narrow, linear, dull olivaceous black, and irregularly scattered along one or two faces of the 3-angled culm (FIG. 2).

In the **ambiens** form the sporodochia are oval, short, dark brown or black, polished, swollen and grouped around the culm at regular intervals (FIG. 9).

Names applied to these two forms in literature.

Affine form

Sclerotium sulcatum Roberge in herb.: Desm. Ann. Sci. Nat. III. **16:** 329. 1851. **Exs.** Desm. Pl. Crypt. Fr. ser. I. ed. 1, *2029;* ser. I. ed. 2, *1629.*

Epidochium affine Desm. in part (excluding specimens on *Schoenus*) Ann. Sci. Nat. III. **20:** 232. 1853. **Exs.** Desm. Pl. Crypt. Fr. ser. II, *21.*

Claviceps (?) *caricina* Griffiths, Bull. Torrey Club **29:** 300. 1902. **Exs.** West Am. Fungi, *400.*

Ambiens form

Epidochium ambiens Desm. Ann. Sci. Nat. III. **20:** 231. 1853. **Exs.** Desm. Pl. Crypt. Fr. ser. II, *20.*

Peziza Duriaeana Tul. Sel. Fung. Carp. **1:** 103. 1861, and **3:** 203, *pl. 22, fig. 20–24.* 1865. **Exs.** Tulasne type material. Mus. Paris.

Sphacelia nigricans (Tul.) Sacc. Michelia **2:** 131, in part. 1880. **Exs.** Roumg. Fung. Gallici, *1200.* (As to plant described; not the conidial stage of *Claviceps nigricans* Tul. upon which the name is based.)

Sclerotium nigricans (Tul.) Sacc. Michelia **2:** 134, in part. 1880, and Syll. Fung. **14:** 1153. 1899. **Exs.** Roumg. Fung. Gallici, *1200.* (As to plant named; not sclerotial stage of *Claviceps nigricans* Tul. upon which name is based.)

Sphacelia ambiens (Desm.) Sacc. Syll. Fung. **4:** 666. 1886. **Exs.** Roumg. Fung. Gallici, *1200.*

Sclerotinia Duriaeana (Tul.) Rehm, Hedwigia **21:** 66. 1882. (As to name only; Rehm: Ascomyceten, *603,* which is here described and cited by Rehm is of the **affine** form.)

Sclerotinia Duriaeana (Tul.) Sacc. Syll. Fung. **8:** 199. 1889.

Hymenoscypha Duriaeana (Tul.) Phillips, Manual Brit. Discom. 115. 1893.

The specimen cited after a name in the above list is the specimen which we believe the author had before him or in mind when applying his name.

In Desmazières' description of *Sclerotium sulcatum* (1851) he says it is "found inside the triangular stubble of *Carex vulpina* and *C. acuta*, and on one or two species with cylindrical culms." We have examined both the specimens cited by Desmazières (*2029* and *1629*). These show only short pieces of culms containing sclerotia and in one case microsporodochia. Specimens of *2029* in the Farlow Herbarium are mounted open on one page of the fascicle. There are two labels. Most of the specimens are said to be on *Schoenus nigricans* though this host is not mentioned in the original description. These show sclerotia only. Two pieces of culms also containing sclerotia only are labelled "*Carex vulpina* et *acuta*." This same number in the N. Y. Bot. Gard. Herbarium is in a packet and consists of a few pieces of culms showing both sclerotia and sporodochia of the **affine** form. The label on this specimen says on "*Carex vulpina* et *acuta*." Speci-

mens of *1629* in the Farlow Herbarium also consist of short pieces of culms containing sclerotia only. The label says on "*Carex vulpina* et *acuta*." It seems clear to the writer, judging from Desmazières' description, an examination of the sclerotia in these specimens and the presence of linear microsporodochia in some of the culms, that Desmazières was dealing with a *Sclerotinia* of the **affine** form.

Two years later Desmazières (1853) described the sporodochial stage of a *Sclerotinia* under the name *Epidochium ambiens*, basing it upon material collected by Roberge (Desm. Pl. Crypt. Fr. ser. II, *20*). The host is given as *Carex*, with no specific designation. Dr. K. M. Wiegand of Cornell University has examined the specimen and thinks it is undoubtedly *Carex paniculata* L. There are no sclerotia in these culms. The sporodochia are abundant and of a strikingly different form from those in the specimens of *Sclerotium sulcatum* referred to above. It is on this specimen that we have founded our **ambiens** form.

At the same time and on the next page Desmazières (1853: 232) described *Epidochium affine*, citing his specimen, number *21*, ser. II. Pl. Crypt. de France. There are two specimens accompanying one label under this number. One packet contains culms and fruiting heads of *Schoenus nigricans* L. These show sporodochia-like bodies, which differ however very distinctly from the sporodochia in the other packet on the culms of what is, according to Dr. K. M. Wiegand, *Carex Hudsonii* Bennett (*C. stricta* Good.). The sporodochia on the *Carex* culms are identical in appearance with those accompanying *Sclerotium sulcatum* in Desm. Pl. Crypt. Fr. ser. I. ed. 1, *2029*, referred to above. Desmazières (1853: 232) says (Transl.): "This small fungus, which, perhaps, is only a variety of the preceding species (referring to *E. ambiens*), is only distinguished by acervuli which do not envelop the culm. They are located on the same side and are not spaced regularly with equal intervals. *Epidochium affine* is often found with *Sclerotium sulcatum*." Since the label accompanying these two packets specifies, as hosts of *E. affine*, not only *Schoenus nigricans* but also "plusieurs Carex," as does also Desmazières' description, it is evident that he regarded the sporodochia on both hosts as one and the same fungus. However

his description of the sporodochia fits those on the *Carex* rather than those on *Schoenus*, for he says: "Acervulis linearibus parallelis." Those on *Schoenus* are broad, almost circular. That the fungus on *Schoenus nigricans* is the same as that on the *Carex* the writer doubts. No *Sclerotinia* appears to be recorded on *Schoenus nigricans*. The sporodochia on the *Carex* culms are undoubtedly to be referred to *Sclerotinia Duriaeana* and constitute the type of our **affine** form.

Through the kind offices of Monsieur Föex of the Station Centrale de Pathologie Végétale, the Director of the Muséum d'Histoire Naturelle in Paris, Monsieur Mangin, has been so good as to loan us for examination Tulasne's specimens of the sclerotial stage of his *Peziza Duriaeana* on *Carex arenaria* L. A single short piece of culm shows the typical sporodochia as pictured by Tulasne. The sclerotia are allantoid and distinctly more slender than those of the **affine** form. They average (42 measurements of dry sclerotia) 8.5 mm. × 1.2 mm. (Compare FIGS. 7 AND 8.)

Saccardo has further confused the situation in as far as it affects the sclerotial and sporodochial stages. There is a specimen in Roumeguère's Fungi Gallici, *1200*, bearing the name *Sclerotium nigricans* (Tul.) Sacc. with the citation, "Michelia VI, p. 134." (The "VI" is a misprint for "II.") An examination of this specimen discloses a culm of *Carex paniculata*, bearing the microconidial sporodochia and a sclerotium of what is undoubtedly the **ambiens** form of *Sclerotinia Duriaeana*. Saccardo, who evidently identified the specimen, refers it erroneously to *Claviceps nigricans* Tul. (Tulasne 1853: 51). Now, based upon this single specimen, he (Michelia **2**: 131, 134. 1880) erects two species, *Sphacelia nigricans* (Tul.) Sacc. and *Sclerotium nigricans* (Tul.) Sacc., to designate what he takes to be two asexual stages of *Claviceps nigricans* Tul. Saccardo's first publication (1880) of the name *Sclerotium nigricans* is unaccompanied by a description. When he later listed this species in the Sylloge (1899) he added a brief description. Here, he gives *Sclerotium Eleocharidis* Thüm. as a synonym and cites Thümen's specimen, *2298*, in Mycotheca Universalis, which is however actually the sclerotial stage of *Claviceps nigricans* Tul. Meanwhile (1886),

having decided that his *Sphacelia nigricans* is identical with *Epidochium ambiens* of Desmazières, he makes the new combination *Sphacelia ambiens* (Desm.) Sacc. but still persists in his erroneous notion that it is the conidial stage of *Claviceps nigricans* Tul. While the descriptions accompanying the names *Sclerotium nigricans* and *Sphacelia nigricans* are in fact based upon the microconidial and sclerotial stages respectively of the **ambiens** form of *S. Duriaeana* as represented in Roumeguère's specimen, *1200*, the names are to be regarded as synonyms of *Claviceps nigricans* Tul. rather than of *S. Duriaeana*.

Both the **affine** and the **ambiens** forms occur in Europe. Thus far only the **affine** form has been found in America, where it is apparently most abundant on *Carex stricta* Lam., though as we shall see later it is not uncommon on a number of other *Carex* species. In Europe the **affine** form would appear to be most common on *Carex Hudsonii* Bennett (*Carex stricta* Good.), although the type specimen of *Sclerotium sulcatum* which has sporodochia of this type was described from *Carex vulpina* L. and *Carex gracilis* Curt. (*C. acuta* L.). The **ambiens** form is the one which Tulasne had in hand when he pictured and described *Peziza Duriaeana* on *Carex arenaria* L. It seems to occur most commonly on *Carex paniculata* L.

The exsiccati specimens of European material of the sporodochial and sclerotial stages which we have been able to examine and upon which the above discussion is based are listed below. The institutional herbaria in which the particular specimens examined are deposited are indicated in each case thus: **N. Y. B. G.** (New York Botanical Garden); **Harvard** (Farlow Cryptogamic Herbarium at Harvard University); **U. S. D. A.** (Mycological Collections, U. S. Dept. Agr.); **C. U. Atk., C. U. Durand,** and **C. U. Pl. Path.** (the Atkinson collection, the Durand collection and the Plant Pathology collection respectively at Cornell University).

Specimens of the **affine** form:

Desmazières: Pl. Crypt. de France, ser. 2, **21,** *Epidochium affine* Desm. (type in part) on *Carex* (*Hudsonii* Bennett ?) (sporodochia only). **N. Y. B. G., Harvard.**

Desmazières: Pl. Crypt. de France, ser. I. ed. 1, *2029*

(type) *Sclerotium sulcatum* Rob. in herb. on *Carex vulpina* L. and *C. acuta* L. (sclerotia and sporodochia). **N. Y. B. G., Harvard;** ser. I. ed. 2, *1629.* **Harvard.**

Lindhart: Fungi hungarici. *381 Peziza Duriaeana* Tul. on *Carex* (*Hudsonii* Bennett ?) (sclerotia and sporodochia). **N. Y. B. G., U. S. D. A.**

Specimens of the **ambiens** form:

Desmazières: Pl. Crypt. de France, ser. 2, **20,** *Epidochium ambiens* Desm. (type) on *Carex* (*paniculata* L.) (sporodochia only). **N. Y. B. G., Harvard.**

Tulasne, Ergot caulinaire des Carex arenaria. Prairie de Fargues, près Langon (Gironde) 24 Juni, 1860. Part of type of *Peziza Duriaeana* Tul. **Herb. Mus. Paris.**

Roumeguère: Fungi Gallici exs. *1200 Sclerotium nigricans* (Tul.) Sacc. on *Carex paniculata* L. (sclerotium and sporodochia). **C. U. Pl. Path., N. Y. B. G.;** *3505 Epidochium affine* Desm. on *Carex paniculata* L. (sporodochia only). **N. Y. B. G., Harvard.**

Roumeguère: Fungi selecti exs. *4600 Sclerotium sulcatum* Rob. on *Carex paniculata* L. (sclerotium only, immature). **Harvard, N. Y. B. G.;** *4682 Sphacelia ambiens* (Desm.) Sacc. on *Carex paniculata* (sporodochia). **N. Y. B. G., Harvard;** *5419 Sclerotinia Duriaeana* Tul. on *Carex* (*paniculata* L.) (sporodochia only). **N. Y. B. G., Harvard.**

deThümen: Mycotheca universalis, *1575 Epidochium ambiens* Desm. on *Carex paniculata* L. (sporodochia and sclerotia). **N. Y. B. G., Harvard** (sporodochia only). (FIG. 9.)

When one turns to the synonomy of the apothecial stage the confusion is hardly less disconcerting. The apothecial stage was discovered by Durieu de Maisonneuve in 1856 on the banks of the Garonne in France. Tulasne (1861: 103) to whom material was sent was the first to apply a name to the apothecial stage, calling it *Peziza Duriaeana* in honor of the collector. Tulasne's work, as he states, was based upon material on *Carex arenaria* L. collected and sent to him by Durieu in 1857, from sclerotia of which he developed apothecia during April and May, 1858.

He clearly had sporodochia in the material sent to him by Durieu as may be seen from Figs. 20–24, Pl. 22, in vol. 3 of his Selecta Fungorum Carpologia. However in his description of the species he treats only the sclerotia and apothecia (Sel. Fung. Carp. **1:** 103–104). That he regarded the sporodochia on *C. arenaria* as identical with *Epidochium ambiens* Desm. is evident from his remarks on the matter and he raises the question whether they are not genetically related to his *Peziza*.

Tulasne seems to have had some doubt of the relation of his fungus to *Sclerotium sulcatum*. He says, speaking of the sclerotium (Transl.), "it is said to be *Sclerotium sulcatum* Rob." He also calls attention to the fact that there is another sporodochial form, *Epidochium affine* Desm., "scarcely different" from *E. ambiens* and remarks that the usual association of this with *S. sulcatum* had not escaped Desmazières. It is clear therefore that Tulasne applied the name *Peziza Duriaeana* to the **ambiens** form.

Rehm (1882) describes the apothecial stage of a *Sclerotinia* on *Carex stricta* Good. (now *C. Hudsonii* Bennett) and refers it to Tulasne's species *Peziza Duriaeana* but transfers the species to the genus *Sclerotinia*. His description of the species is based upon the specimens distributed in Rehm: Ascomyceten, *603*. No reference is made by Rehm to sporodochia. Since however all sporodochial specimens which we have seen on *C. Hudsonii* are of the linear scattered type, there can be little question but that Rehm's apothecial material belongs to the **affine** form.

Saccardo (Syll. **8:** 199. 1889) writes the combination, "*Sclerotinia Duriaeana* Tul." Since Tulasne never transferred his species, *Peziza Duriaeana*, to the genus *Sclerotinia*, this is either a careless error on Saccardo's part, or an intentional transfer which he has failed to correctly indicate. In any case it is necessary to include *Sclerotinia Duriaeana* (Tul.) Sacc. in the synonymy.

Boudier (1885) cites *Peziza Duriaeana* Tul. along with *P. tuberosa* Hedw. and *P. subularis* Bull. as examples of his sub-genus *Sclerotinia* in the genus *Ciboria*. Rehm (1896 in Rabenhorst's Kryptogamen Flora) lists *Sclerotinia Duriaeana* Quél., citing "Bull. Soc. Myc. Fr. **1:** 115," which however is the 1885 paper

by Boudier. This is either an error as to author or as to article. Rehm's treatment of the synonymy here would seem to indicate that he now had reasons to hold that Quélet should be credited with the combination *Sclerotinia Duriaeana* instead of himself.

The next investigator of this species to use the combination of authors, "(Tul.) Quél.," was Boudier (1907) in his Icones Mycologicae. He, however, cites no authority for designating Quélet as the author who made the transfer from *Peziza* to *Sclerotinia*. A most careful and exhaustive search through the numerous publications of Quélet has failed to show that this worker ever made the transfer. A similar search of Boudier's works has been equally fruitless. It seems strange indeed that Boudier, a close friend and colleague of Quélet, should be in error in this matter. Rehm's earlier use (1896) of Quélet's name as author of the transfer would also strengthen the supposition that somewhere Quélet may have made the combination now generally attributed to him. However, in view of our failure to find published evidence of this and since such a transfer was made by Rehm himself as early as 1882, our only course appears to be to credit Rehm with having been the first to make the combination, *Sclerotinia Duriaeana*.

Since Boudier does not specify the species of *Carex* from which his material came and concerns himself only with the apothecial stage, it is impossible to tell with certainty to which of the two forms, **affine** or **ambiens,** his specimens belonged, more probably to the latter.

The exsiccati specimens of European material of the apothecial stage which we have examined are here listed:

Affine form.

Rehm: Ascomyceten, *603 Sclerotinia Duriaeana* (Tul.) on *Carex stricta* Good. **C. U. Durand;** *603b Sclerotinia Duriaeana* (Tul.) on *Carex stricta* Good. **C. U. Durand.**

Rabenhorst-Winter: Fungi Europaei, *2749 Sclerotinia Duriaeana* (Tul.) on *Carex stricta* Good. **C. U. Durand.**

Ambiens form.

None.

Although, as we have pointed out in a previous article (Mycologia **18:** 233), apothecial characters are usually of little diag-

nostic value for separating species of *Sclerotinia;* nevertheless they must always be taken into consideration. When, however, we undertake to make a comparison of the available data on the apothecial structures of these two supposed forms, we find the information too scant to warrant the drawing of conclusions therefrom. The following measurements constitute all the available evidence we have from European sources on the apothecial stages.

Affine form.

Rehm: Hedwigia **21:** 66 on *C. stricta* Good., asci 140 × 8 μ, ascosp. 10–14 × 4–6 μ.

Rehm: Ascom. *603* on *C. stricta* Good., asci 133.5–182 × 7.8–9.1 μ, ascosp. 10.8–15 × 4.8–6 μ.[2]

Rabenhorst-Winter: Fung. Europ. *2749* on *C. stricta*, asci 127.5–170 × 7.8–11.7 μ, ascosp. 10.2–15 × 5.4–7.2 μ.[3]

Rehm: Ascom. *603b* on *C. stricta* Good., asci 146–164 × 7.3–9.1 μ, ascosp. 10.7–12.4 × 5.3–7.9 μ.[2]

Rehm: Rab. Krypt. Fl. **3:** 820 on *C. stricta* Good., asci 140–180 × 8–9 μ, ascosp. 12–18 × 5–9 μ.

Ambiens form.

Tulasne: Carp. **1:** 104 on *C. arenaria*, asci (80–95)[4] × 8–9.5 μ, ascosp. 10–15 × 6.5–7.5 μ.

Boudier: Icon. **4:** 274 on *Carex* sp.,[5] asci 210–230 × 7–15 μ, ascosp. 14–18 × 6–7 μ.

In spite of the marked similarity in size of asci and ascospores as indicated in the above measurements, there remain two features in which the **affine** and the **ambiens** forms differ. First and most striking is the form and distribution of the sporodochia which has already been pointed out and emphasized. There also appears to be a distinct difference in the sclerotia of the two forms. Judging from the abundant sclerotia in Tulasne's type material on *C. arenaria* and the few sclerotia present in the specimens on *C. paniculata* which we have seen, the sclerotia of

[2] Our measurements from dry material in KOH.

[3] Measurements made by us from same material on which Rehm presumably based his own measurements.

[4] Tulasne says, "asci about 10 times as long as broad"; may not have taken into account lower nonsporogenous part of ascus.

[5] Boudier does not specify species of *Carex* from which his material came, but probably it was *C. arenaria* or *C. paniculata.*

the **ambiens** form are distinctly more slender, being of nearly uniform diameter throughout their length. They are also more generally curved. They show little or no trace of striations, and are of a dark brown rather than jet black color (FIG. 8). The sclerotia of the **affine** form on the other hand are distinctly fusiform, being decidedly thicker at the center. While they vary markedly in length and thickness in the different host species, they are always relatively stout, *i.e.* thick for their length. They are jet black, finely striated and only slightly curved in the larger specimens, and even here the curving is more apparent than real (FIG. 7).

One appears then to have the choice of two interpretations of the situation presented above: either,

(1) The fungi commonly referred by European workers in the past to *S. Duriaeana* are one and the same species, the sporodochia varying strikingly on different species of *Carex;* or

(2) Two species of *Sclerotinia*, very similar in respect to sclerotia and apothecia but with strikingly different sporodochia, have been confused by European mycologists up to the present. The form occurring on *C. arenaria* and *C. paniculata* is the true *Peziza Duriaeana* of Tulasne, the other, an as yet unnamed species, occurring in Europe on *C. Hudsonii* Bennett, *C. gracilis* Curt., *C. vulpina* L. and possibly also on *Schoenus nigricans* L. as well as on several species of *Carex* in America.

It seems impossible to settle this question until we can collect and culture the forms on the different species of *Carex* in Europe. For the present we have chosen therefore to accept the first interpretation and to apply the name *S. Duriaeana* (Tul.) Rehm to both the **ambiens** and **affine** forms, though from the evidence now available to us we are inclined to believe that the second interpretation is the correct one. Should further researches confirm the occurrence of two distinct species, we would give to the **affine** form the name **Sclerotinia sulcata** (Desm.) **n. comb.** since the first species name applied to it was that of Roberge, used on sclerotial specimens and adopted by Desmazières in his description of *Sclerotium sulcatum*. The **ambiens** form, evidently that which Tulasne had in hand, should bear the name *Sclerotinia Duriaeana* (Tul.) Rehm.

THE AUTHOR'S STUDIES ON COLLECTIONS OF SCLEROTINIA DURIAEANA IN NORTH AMERICA

Specimens of *S. Duriaeana* were first taken by the writer in the McLean Swamp on April 26, 1921. Only a few were found at that time. They were scattered among those of our new species, *Sclerotinia longisclerotialis*, which were present in great abundance and which we were particularly seeking. The apothecia and sclerotia of *S. Duriaeana* (FIGS. 5 AND 6) are distinguished at once from those of *S. longisclerotialis* (FIG. 13) by the shorter stipes and broader cups as well as by the short, thick and pointed sclerotia. Apothecia of *S. Duriaeana* were taken in the same marsh on May 10, 1925, at which time they were again found in limited numbers. Observations during the summer of 1925 indicate that infection by the ascospores of this species is exceedingly common, in fact, very general, on its chief *Carex* hosts throughout the swamp.

Our American species of the *Sclerotinia Duriaeana* type undoubtedly belongs to the **affine** form as may be seen from the photographs (FIGS. 1 AND 2). Thus far nine species of *Carex* have been found to be hosts for it in North America. It occurs about Ithaca in abundance on *Carex stricta* Lam., a species closely related to one of its common European hosts, *C. Hudsonii* (*C. stricta* Good.). It also occurs to a considerable extent upon *Carex prairea*, which is at the same time the principal host for *S. longisclerotialis*.

We have discovered but one American collection of *S. Duriaeana* made earlier than our own. In August 1901, Griffiths and Morris collected the sclerotia and sporodochia of a fungus on *Carex nebraskensis* Dewey near Andrews, Oregon. Griffiths (1902) described it as *Claviceps? caricina* sp. nov., saying, "No one recognizes better than the writer that the placing of the species in the genus *Claviceps* is a wild guess." An examination of specimens from this collection, distributed under number *400* West American Fungi, shows it to be without doubt a *Sclerotinia* of the **affine** form. The sclerotia and sporodochia correspond in every way with these structures as we find them in the form on *Carex* species about Ithaca. Attempts to obtain living material on this host from Andrews, Oregon, for cultural studies have been in vain.

A collection of this species on *C. stricta* Lam. has recently been received from J. R. Schramm, collected by him near Wilson Station, Del. (**C. U. Pl. Path.** *17028*).

There is little doubt that this species is widely distributed throughout North America where *Carex* species abound. It will probably be found on many species of *Carex* in addition to those listed below.

LIFE HISTORY. Although no inoculation experiments have been conducted, field observations and studies of the fungus in pure culture indicate the main features of its life history.

The sclerotium, as it matures, causes the culm to crack open on one or more of its faces (FIG. 3). The culm, weakened at this point, breaks over and frees the sclerotium (FIG. 4C), which falls into the water below or among the growing culms of the host. Here it lies throughout the winter and early in the spring gives rise to the short, stout-stemmed apothecium (FIG. 5). Each sclerotium usually produces but one apothecium, rarely two. One may occasionally find an apothecium arising upon a sclerotium still enclosed in the old partially rotten culm (FIG. 6). However, the retention of the sclerotium in the culm until it falls over is apparently not common. The apothecia begin to open and discharge their ascospores as the young inflorescence of the host emerges from the upper leaf sheath. The first parts of the inflorescence of *C. stricta* to be exposed are the male spikes and observations seem to indicate that it is through these male spikes that invasion by the germ tubes of the ascospores occurs. There is much evidence that infection proceeds from the male flowers downward through the culm, which is usually killed entirely to the crown, though in a large number of cases infection seems to be halted one half or two thirds of the way to the base. It is possible that invasion may sometimes be through the female flowers but they usually appear to die because of the death of the culm to which they are attached. The actual method of invasion remains to be investigated and the carrying out of careful inoculation experiments for this purpose is highly desirable. No observations on the point of invasion in the other host species of *Carex* have been made.

The first evidence of infection is a withering and drying up of

the spikes followed by a progressive downward hydrosis of the culm. As the infection proceeds there is often a succession of color changes, especially in *C. stricta*, giving to the diseased portion a more or less banded appearance due to the alternating light and dark regions in the lesions (FIG. 1). The infected culms are eventually blanched, becoming straw colored or even white as is the case in *C. prairea* and *C. interior*.

In the upper part of the affected culm and especially just below the spikes, minute linear dark brown bodies, microconidial sporodochia, are formed in considerable numbers (FIGS. 1 AND 2). They begin to appear shortly after infection becomes evident. The minute microconidia ooze out in a watery mass from slits in the cuticle over the sporodochia. No attempts to germinate the microconidia of this species have been made by the writer. Although Brefeld (1891: 316–317) failed to obtain germination of the microconidia of *S. Duriaeana* and of other related species, it seems possible from the work of Ferdinandsen and Winge (1911: 297) on *S. scirpicola* that the microconidia may germinate and produce secondary infection during the summer. They more probably function as do the spermatia of the rusts (Craigie, 1927).

Formation of sclerotia in this species begins relatively early in the summer as they are to be found in large numbers even in June. They usually develop at or below the middle of the culm. There is in general but one sclerotium per culm though two and even three are not infrequent.

The culms break over, freeing the sclerotia as already described. The apothecia appear in April and May of the following year and are usually most abundant in late April or early May, depending of course upon the season which correlates their development with the development of the inflorescences of the different hosts.

CULTURAL CHARACTERS. Grown on the following standard media,[6] potato agar, oat agar and nutrient agar, this species exhibits the following characteristics: Sclerotia and microconidia only are produced. The sclerotia mature in about 20 days upon potato agar, especially in test tube slants though occasion-

[6] For method of preparing these media see Mycologia **18:** 230.

ally in petri dishes (FIGS. 17 AND 18). They are large, black when mature, more or less loaf-shape, and usually form against the glass at the base of the slant (FIGS. 14 AND 15). The interior, showing where the surface adheres to the glass, is of a light pink color, which at once distinguishes this species in culture. On potato agar in petri dishes or slants there is an abundant development of white cottony aërial mycelium (FIG. 16), becoming brownish gray with age. Microconidial sporodochia of a dark brown to black color are formed about the margin of old cultures (FIGS. 18 AND 19). Brefeld (1891: 316) reports this abundant production of white aërial mycelium and microconidia in his cultures from ascospores of *S. Duriaeana*. Growth on oat agar is less vigorous. Growth on nutrient agar is very poor with scarcely any aërial mycelium. This medium becomes slightly but distinctly reddish brown under the colony; no sclerotia formed.

This species is readily distinguished in culture from *S. longisclerotialis* by its dense cottony growth of aërial mycelium and by the development on potato agar of large loaf-shaped sclerotia which are pink within. (Compare FIGURES 16 AND 20 AND 14 AND 22. No sclerotia of *S. longisclerotialis* have been obtained in culture.) The submerged mycelium of *S. Duriaeana* in potato agar turns a dirty brown with age while that of *S. longisclerotialis* darkens but little or not at all in this medium.

DESCRIPTION OF SCLEROTINIA DURIAEANA[7] (**affine form**)

The sporodochia (FIG. 2) are scattered, *i.e.* not occurring in groups at regularly spaced intervals along the culm; usually confined to the upper part of the culm above the first sclerotium, but sometimes sparsely produced below, between sclerotia; almost always confined to two faces of the 3-sided culm; distinctly linear, 2–5 mm. long by $\frac{1}{3}$–$\frac{1}{2}$ mm. broad; dull olivaceous brown, inconspicuous, opening by a longitudinal slit when mature, from which ooze the masses of microconidia. These sporodochia lie imbedded in the tissues between the vascular bundles just

[7] Although Tulasne (1861: 103–105) gives an excellent and detailed description of the species, it seems desirable to present here a brief diagnosis based upon our studies of American material, especially since the American form as already pointed out may prove to be distinct from *S. Duriaeana* of Tulasne.

beneath the epidermis of the culm. They consist of numerous dense masses of microconidia cut off in chains from the Indian-club-shaped conidiophores which arise in fascicles from a single cell of the mycelium. Each sporodochial fruit body is thus compounded of numerous fasciculate globose masses of conidiophores which appear in cross section as star-like centers isolated in the mass of microconidia (Tul. Carp. **3:** Pl. 22, Fig. 21). The structure of the sporodochial masses in this species is essentially like that of the sporodochia of *S. longisclerotialis* (FIG. 23). The cavities in which they lie have been formed by the dissolution of the parenchymatous tissues of the culm. The vascular bundles and the epidermis remain apparently unaffected except for the rupture of the latter to afford escape for the microconidia. The microconidia are globose, about 2 μ in diameter, hyaline; produced, probably as in *Botrytis* (Brierley, 1918: 133–134), each conidiophore giving rise to a large number of microconidia.

Sclerotia, one to three in each culm; when mature, exposed by the rupture of the epidermis along one or two faces of the culm, which thus weakened soon breaks over, widening the slit and allowing the sclerotium to fall; black, fusiform, much resembling the ergots of *Claviceps*, often inequilateral or slightly curved in the larger specimens. These sclerotia originate as loose cottony, white, hyphal masses in the interior of the culm. Each mass gradually thickens, becoming a compact, firm fusiform body of a beautiful pale pink color. As it matures and ripens, this color changes to a smoky gray and finally black. The pointed or rounded ends of the black sclerotium are each capped for a time by a white hyphal weft continuous with the mycelium in the tissues (FIG. 4a). The sclerotia vary greatly in size, according to the slenderness of the host culm in which they are formed. The largest we have seen are those produced in culms of *C. riparia* var. *lacustris*, which are usually 20–25 mm. long by 3–4 mm. thick and strongly 3-angled. The smallest are those formed in the very slender culms of *C. interior*. These are short truncate averaging 4–5 × 1½–2 mm. Those in *C. stricta* are usually more fusiform pointed, averaging 6–8 × 2–2½ mm. (FIG. 4c). The sclerotia are in all hosts more or less 3-angled, the angles rounded and the surface striate due to the pressure of the vascular

bundles on the sclerotium while developing in the culm. The mature sclerotium shows in cross-section a white medulla surrounded by a thin black rind (TEXT FIG. 1).

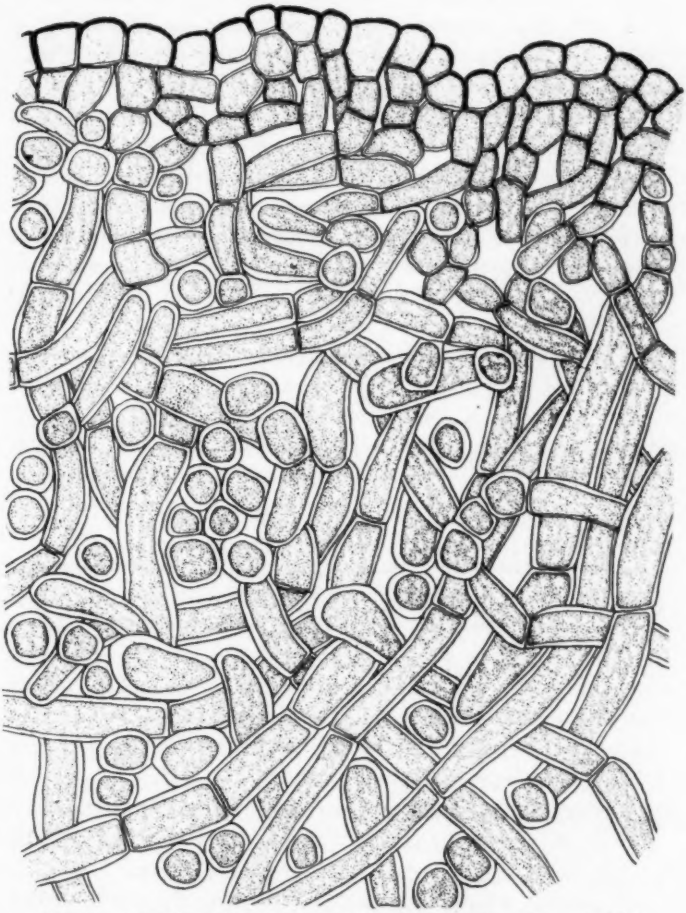

FIG. 1. Sclerotium of *S. Duriaeana* from *Carex stricta* culms. ×1900

The apothecia (FIG. 6) are from 2 to 10 mm. broad when fully expanded, mode 5 mm., from deep goblet-shaped to shallow funnel-shaped, when fully mature, fawn colored, varying in size

with the sclerotium from which they arise; stipe rather short, 5–20 mm. long, darker below. Paraphyses slender, slightly swollen, long clavate at apex, hyaline.

Asci 8-spored, slender, blunt at apex, slightly attenuated below; 106 measurements from 6 apothecia from *C. stricta* give a variation of 128–183 × 7.3–11 μ, averaging 161 × 8.6 μ with a mode of 155.8 × 9.16 μ.

Ascospores hyaline, uniseriate, long ovate, often inequilateral; 205 measurements from 5 apothecia from *C. stricta* give a variation of 8.8–17.5 × 5.3–8.8 μ, averaging 12.6 × 6.9 μ with a mode of 13.1 × 7.09 μ. The ascospores allowed to discharge on the surface of potato agar germinate readily and form a dense cottony growth (FIG. 16) of limited extent, showing no tendency to feathery rhizomorphic strands as in *S. longisclerotialis* (FIG. 20).

Found in wet open *Carex* swamps. In North America, most common and abundant on *Carex stricta* Lam.;[8] occurring also on *C. prairea* Dewey, *C. interior* Bailey, *C. hystericina* Muhle., *C. riparia* Curt. var. *lacustris* (Willd.) Küken, *C. flava* L., *C. rostrata* Stokes, and *C. crinita* Lam., in the vicinity of Ithaca and McLean, N. Y. It is also known on *C. nebraskensis* Dewey from Andrews, Oregon.

In Europe, the **affine** form is recorded on *C. Hudsonii* Bennett (*C. stricta* Good.), *C. vulpina* L. and *C. gracilis* Curt. (*C. acuta* L.).

HERBARIUM MATERIAL.—The herbarium specimens here listed are North American collections only. The European specimens which the writer has examined are listed on p. 10–11. Unless otherwise indicated the numbers refer to specimens collected about Ithaca and deposited in the herbarium of the Department of Plant Pathology, of Cornell University.

On *C. stricta*, (apoth.) *11515* **type,** *14148, 14184, 15146;* (sclerot.) *14747;* (sporod.) *15810, 15813, 15816, 15187, 15883;* (sclerot. and sporod.) *17044* (Delaware).

C. prairea, (apoth.) *15160;* (sclerot.) *14947, 15809, 15873;* (sporod.) *15811, 15812, 15815, 15821.*

[8] All host species have been determined by K. M. Wiegand of the Botanical Department of Cornell University. The nomenclature followed is that used in the Flora of the Cayuga Lake Basin, New York. Cornell University Agr. Exp. Sta. Mem. 92. 1925.

C. interior, (sclerot.) *15867;* (sporod.) *15814*, *15820*.
C. riparia, (apoth.) *15627;* (sclerot.) *15176*.
C. hystericina, (sclerot. and sporod.) *15009*, *15818*.
C. crinita, (sclerot. and sporod.) *15795*.
C. rostrata, (sclerot. and sporod.) *15884*.
C. flava, (sclerot. and sporod.) *15865*.
C. Nebraskensis, (sclerot. and sporod.) West Amer. Fung. *400* (Oregon).

Duplicates from our collections have been deposited in the herbaria of Harvard University; New York Botanical Garden; Mycological Collections, Bur. Pl. Ind. U. S. Dept. Agr.; University of Wisconsin; Kew Gardens, England; and Muséum d'Histoire Naturelle, Paris, as follows: Nos. *15146*, *15816*, *15160*, *15873*.

NOTES

We have seen but two specimens from North America heretofore definitely referred to *S. Duriaeana*. One was collected by Clements (Webber, 1892: 47) in the woods at Lincoln, Nebraska, Apr. 27, 1892. This specimen was determined by Clements. Examination of this material (in the Durand collection, Cornell University) shows several small apothecia arising from a large loaf-shaped sclerotium apparently buried in the soil. While measurements of asci and ascospores of this material show them to approximate the size and shape of these structures in our material of *S. Duriaeana*, the character of the sclerotium and its habitat would seem to invalidate Clements' reference of it to this species.

The other specimen was one collected by Vahl in 1829 near Nonnese, Greenland. The host is given as *Carex rigida* Good. The fungus was determined by Rostrup as "*S. Duriaeana* Tul." and is in the Rostrup collection now deposited in the Botanical Museum of the University of Copenhagen. Through the kindness of the curator of the museum we have been able to examine this specimen. It consists of a group of 3 large triangularly conical, pointed sclerotia evidently formed at the base of the leaves of a stunted culm. A single long stalked apothecium arises from the base of one of these sclerotia. On comparing this specimen with specimens of *S. Vahliana* Rostrup, No. *730*

in Vestergren, Mycomycetes variores selecti, on *Eriophorum angustifolium* (**Myc. Coll. U. S. D. A.**) and with another specimen of the same fungus on *Eriophorum polystachium* distributed by Nannfeldt in Fungi Suecici (**N. Y. B. G. Herb.**), both collected in Arctic Scandinavia, it seems certain that the Greenland specimen is *S. Vahliana* rather than *S. Duriaeana* and that the host of Vahl's specimen is an Eriophorum rather than a Carex.

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SCLEROTINIA LONGISCLEROTIALIS

This was the first species of *Sclerotinia* on *Carex* collected by the writer. Walking through an open *Carex* swamp near McLean, N. Y., on May 16, 1918, in company with several colleagues, we were astonished to discover large numbers of small goblet-shaped apothecia protruding from the water in the shallow pools among the *Carex* hummocks. When we began to collect them it was discovered that they arose from long slender black sclerotia lying in the debris at the bottom of the pools or hidden in the wet sphagnum moss on the sides of the hummocks. It soon became evident that they had been formed in last year's culms of some species of *Carex*, several of which were abundant

here and at this time showing well exposed new inflorescences. It was not possible to determine at the time with certainty just which species was the host of this *Sclerotinia*. Photographs of the apothecia attached to sclerotia (FIG. 13) and cultures from ascospores (FIG. 20) were obtained. Subsequent collections of the apothecia have been made in this same swamp nearly every spring, during the latter part of April or some time during May.

During the summers of 1925, 1926 and 1927 the swamp was visited on several occasions in June, July, August, September and October to follow the development of infections which are always abundant there by mid-June on several species of *Carex*. It was important to determine first which species were the hosts of this *Sclerotinia* and which were hosts of *S. Duriaeana*.

Carex prairea Dewey was from the first suspected to be the chief host of *S. longisclerotialis*. As the summer advanced, the short stout fusiform sclerotia of *S. Duriaeana* appeared in abundance in the diseased culms of *Carex stricta* and also here and there in those of *Carex prairea*. By mid-July the sclerotia of this species were common and maturing, but not a sclerotium of *S. longisclerotialis* was discovered until Aug. 22, when, running a diseased culm of *C. prairea* between the thumb and finger, the firm, young sclerotia, as yet for the most part completely enclosed, were readily detected. On opening the culms the sclerotia were found to be just taking on the dark color. A few culms showed a long slit on one face near one of the angles of the 3-sided culm through which the black sclerotium was visible (FIG. 12). By September many of the sclerotia were apparently nearly mature and partially exposed by the slit in the culm. Even in early October most of them were still enclosed in the culms which were now falling over, bending not at the sclerotium as in *S. Duriaeana* but usually at the base.

Infected culms of *C. prairea* were collected on June 19 and again on July 3, 1925, from which tissue plantings were made. Most of these gave cultures typical of those obtained from ascospore shootings of *S. longisclerotialis* though occasional plantings gave cultures characteristic of *S. Duriaeana*. Plantings made later from the long slender sclerotia gave cultures like those obtained from ascospore shootings of *S. longisclerotialis*.

While collecting diseased culms of *Carex prairea* during June and July, it was observed that the very slender culms of *Carex interior* Bailey showed infections and black sporodochial bodies (FIG. 11) similar to those in the former host species. Tissue plantings from these culms gave typical cultures of *S. longisclerotialis* but no sclerotia were discovered in the culms of this host until September 4, 1927. They were then just beginning to color and were still completely enclosed in the culms except for an occasional one which showed the rupture slit. While collecting at Pleasant Lake, Maine, on August 25, 1927, *S. longisclerotialis* was taken on *C. interior* and three other species, *C. vesicaria*, *C. retrorsa*, and *C. crinita*. The last three hosts all showed sporodochia and sclerotia. The sclerotia were still firmly enclosed and had scarcely begun to turn black. It is thus clear that *S. longisclerotialis* begins formation of sclerotia later in the season than does *S. Duriaeana* and does not mature them until late summer or autumn instead of mid-summer. Apothecial formation and infection also appear to occur somewhat later in the spring. Apothecia of both species have been taken on the same day as early as April 26 and as late as May 24 but the peak for apothecial production appears to be at least a week or more earlier for *S. Duriaeana* than for *S. longisclerotialis*.

LIFE HISTORY.—The life history of *Sclerotinia longisclerotialis* as here presented is based upon field observations and studies of the fungus in pure culture. No infection experiments have been made.

The sclerotia mature within the culms of the host during late August and September. Although the culms may crack open, exposing the sclerotia, many, if not most, of the sclerotia remain in place until after the culms fall over. They are to some extent freed during the winter and spring by the partial disintegration of the enclosing tissues of the host. Many of them are to be found still enclosed in the rotting culms at the time of apothecial production (FIG. 13). During late April and May of the year following their formation, the sclerotia give rise to the apothecia, which mature shortly after the inflorescence of the host emerges from the upper leaf sheath. The apothecia are found in greatest abundance in the bottom of the pools about the hummocks of

their hosts, though some are always to be found in the wet sphagnum or decaying leaves on the sides of the hummocks. The long-stiped apothecia lifting their goblet-shaped cups above the water present a striking and exciting picture for the collector.

The ascospores are shot into the air and, falling on the young flowers of the host, germinate and cause infection. Through what organs of the flower the germ tubes gain entrance was not determined. Infection must occur early in the development of the inflorescence as it is killed while the spikes are still crowded on the axis. In the case of *C. prairea* at least, the axis of healthy heads rapidly elongates, separating the spikes. Affected inflorescences present an erect, compact aspect in contrast to the slender drooping form of the healthy heads (FIG. 10). The infected inflorescence turns brown and dies. The bracts and flowers persist until well into autumn. In diseased plants of *C. interior*, however, the female flowers quickly fall away. The infection spreads downward through the culm, which loses its green color and exhibits broad bands of alternating light and dark brown shades (FIG. 10).

At rather uniform distances along the upper part of the diseased culm just below the inflorescence there soon appear groups of the short black sporodochia (FIGS. 11 AND 12), containing the microconidia, the role of which in the life history of the fungus is problematical as has been pointed out in the case of *S. Duriaeana*. No attempts to germinate the microconidia of this species have been made.

Sclerotial production begins sometime in late July or early August, usually about midway of the diseased culm. There is usually but one sclerotium per culm though two or even three are not uncommon. The ripe sclerotia fall to the ground, for the most part still enclosed in the culms, there to lie in the water or among the rotting culms in the hummocks until the following spring when they germinate, producing apothecia as already described.

CULTURAL CHARACTERS.—Ascospore sowings on potato agar germinate promptly, giving a characteristic and rapid growth. A white rhizomorphic growth of appressed feathery, aërial mycelium rapidly covers the surface of the media (FIG. 20). The

rhizomorphic feathery habit is often not so evident on potato agar test tube slants, becoming after a time more dense and felty but never showing the cottony masses so characteristic of *S. Duriaeana*. On oat agar, growth is sparse and the white aërial mycelium is thin and webby. Growth on nutrient agar is similar to that on oat agar, the media taking on a dirty reddish brown tint. The submerged mycelium darkens but little or not at all with age on potato agar.

Sclerotia have never been obtained in culture on any media. Black microconidial crusts are sometimes formed with age along the margin of the slant in potato agar in test tubes (FIGS. 21 AND 22). Microconidial masses also sometimes appear in old petri dish cultures on potato agar.

DESCRIPTION OF **Sclerotinia longisclerotialis** N. SP.

The sporodochia are formed in groups at rather regularly spaced intervals along the culm; most abundant and prominent just below the spikes, sometimes present also below the sclerotium toward the base of the culm; usually confined to two faces of the 3-angled culm; short, shining black, ovate oblong, opening by a slit from which ooze the masses of microconidia. Microconidia globose, 1–2 μ in diameter, produced successively from clustered Indian-club-shaped conidiophores. The internal structure of these sporodochia corresponds to that in *S. Duriaeana* and is clearly indicated in the cross section sketch (FIG. 23). In external appearance and arrangement the sporodochia of *S. longisclerotialis* are strikingly different from those of the American form of *S. Duriaeana*. (Compare FIGS. 11 AND 12 with FIG. 2.) They are almost identical in appearance with those of the **ambiens** form of *S. Duriaeana* as described and figured by Tulasne (Carp. **3:** pl. 22, fig. 20). (Compare FIGS. 11 AND 12 with FIG. 9.)

Sclerotia usually one or two, sometimes three in each culm; remaining enclosed even at maturity, not discharged by breaking over of the culm as in the case of *S. Duriaeana;* somewhat exposed by a narrow slit in the epidermis; at maturity black, oblong, truncate, uniform in thickness, more or less 3-angled; striate due to the pressure of the vascular strands of the culm during

development. They originate as loose cottony wefts of white mycelial hyphae in the interior of the culm. These gradually thicken, forming a firm body at first of a pinkish color gradually changing to a smoky gray color on the exterior, finally black. The truncate ends are each capped by a long pointed weft of white mycelium continuous with the mycelium in the tissues of the culm. This disappears after the sclerotium inclosed in the culm falls into the water. Mature sclerotia vary in size with the slenderness of the host culm, ranging from 1 cm. long by 1 mm. thick in culms of *C. interior* to 7 cm. long by 2 mm. thick in culms of *C. retrorsa;* in cross section showing a loose central hyphal medulla surrounded by a densely woven very narrow white medullar zone, the hyphae of which run more or less parallel with the long axis of the sclerotium. The black rind consists of a very thin one-celled layer of pseudoparenchyma supported by the dense outer medullar zone of hyphae.

Apothecia 2 to 5 mm. broad, goblet-shaped, with slender stipes 15–30 mm. long; mouth constricted, never becoming widely open or reflexed expanded (FIG. 13). The cup is of a dark fawn color, the stipe paler and smooth above, below dark tomentose, arising from the long slender sclerotium. Usually but one apothecium from each sclerotium, rarely two to three.

Paraphyses simple, very slender, slightly clavate, septate.

Asci long cylindric, attenuate below the middle; 136 measurements from 5 apothecia from *C. prairea* gave a variation of 170–230 × 8.8–14.3 μ, averaging 182.1 × 10.7 μ with a mode of 194 × 10.4 μ.

Ascospores strongly inequilateral, flat or incurved on one side; 289 measurements from 5 apothecia from *C. prairea* gave a variation of 12.6–22.8 × 5.3–12.5 μ, averaging 18.3 × 8.1 μ with a mode of 21 × 9 μ.

The ascospores allowed to discharge on the surface of the media germinate and grow readily on potato agar, forming a white, more or less appressed feathery mat of mycelium. No sclerotia are produced. Microconidia are abundantly produced on the mycelium in old cultures, forming minute, hard masses, especially on the glass along the edge of potato agar slants (FIGS. 21 AND 22).

Found in open *Carex* swamps, often in association with *S. Duriaeana*. Most common and abundant on *Carex prairea* Dewey; occurs also on *C. interior* Bailey, *C. crinita* Lam., *C. vesicaria* L., and *C. retrorsa* Schw. Known only from the vicinity of McLean, N. Y., and Pleasant Lake, Maine.

HERBARIUM MATERIAL.—All numbers refer to specimens deposited in the herbarium of the Department of Plant Pathology, Cornell University, and, unless otherwise indicated, collected about McLean, N. Y.

On *C. prairea*, (apoth.) *10544* **type**, *11516, 14179, 15149, 15161, 15162;* (sclerot.) *14946, 15824, 15872;* (sporod.) *14748, 15823, 15825.*

C. interior, (sclerot.) *15868;* (sporod.) *14753, 15822, 15859* (Maine).

C. vesicaria (sporod. and sclerot.) *15860* (Maine).

C. retrorsa, (sporod. and sclerot.) *15059* (Maine).

C. crinita, (sporod. and sclerot.) *15858* (Maine).

Duplicates from our collections have been deposited in the herbaria of Harvard University; New York Botanical Garden; Mycological Collections, Bur. Pl. Ind. U. S. Dept. Agr.; University of Wisconsin; Kew Gardens, England, and Muséum d'Histoire Naturelle, Paris, as follows: *15161, 14179, 14946, 14753.*

NOTES.—We have found no description of a *Sclerotinia* on *Carex* approaching our species, especially in the form of its sclerotium. Its asci and ascospores are both much larger than those of *S. Duriaeana* from which it is clearly separated also by the form of its sclerotium. While it has been collected only in two widely separated localities, it will probably be found throughout northeastern United States and Canada where its hosts occur. It is well worth getting one's feet wet just for the joy of finding and admiring this beautiful and interesting species.

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PLATE 2

Morphology of *Sclerotinia Duriaeana*

Fig. 1. Aspect of infected plants of *Carex stricta* as they appear toward end of June. Inflorescence killed at time of flowering. Healthy plant at left. Nat. size. C. U. Pl. Path. Herb. *14747.*

Fig. 2. Microconidial sporodochia in upper part of culms of *C. stricta.* 2 × nat. size. C. U. Pl. Path. Herb. *14747.*

Fig. 3. Sclerotia in culms of *C. prairea* in different stages of development, early in July. 2 × nat. size. C. U. Pl. Path. Herb. *14947*.

Fig. 4. Nearly mature sclerotia from culms of *C. stricta; a* and *b*, showing appendage-like wefts of white mycelium at the end of the sclerotium which disappear with maturity of the sclerotium; *c* and *d*, mature sclerotium being discharged from the culm; *e*, sclerotium breaking in attempt to free itself from the culm. 2 × nat. size. C. U. Pl. Path. Herb. *14747*.

PLATE 3

Morphology of *Sclerotinia Duriaeana*

Fig. 5. Young apothecia from sclerotia produced the previous season in culms of *C. stricta*. Nat. size. C. U. Pl. Path. Herb. *15146*.

Fig. 6. Fully developed apothecia; upper row from sclerotia in culms of *C. stricta;* lower row from sclerotia in culms of *C. prairea*. Nat. size. C. U. Pl. Path. Herb. *11515*.

Fig. 7. Sclerotia removed from culms of *C. prairea*. Nat. size. C. U. Pl. Path. Herb. *15873*. Compare as to size and shape with sclerotia in Fig. 8.

Fig. 8. Sclerotia from Tulasne's type material of *S. Duriaeana* in culms of *C. arenaria*, a species having culms of about the same size as *C. prairea*. Note that they are more slender than those of the American form (Fig. 7). Nat. size. C. U. Pl. Path. Herb. *17044*.

Fig. 9. Sporodochia and sclerotium in culm of *C. paniculata*, from specimen in de Thümen's Mycoth. Univ., No. *1575*, distributed under the name *Epidochium ambiens* Desm. Nat. size. C. U. Pl. Path. Herb. *15912*.

PLATE 4

Morphology and Cultural Characters of *Sclerotinia longisclerotialis* Whetzel

Fig. 10. Aspect of infected plants of *Carex prairea;* two heads at left alive and healthy, four at right killed at blossoming time. Taken June 19, 1925. Note color banding of culms at right. Nat. size. C. U. Pl. Path. Herb. *14748*.

Fig. 11. Aspect of infected plants of *Carex interior;* three heads at right healthy, others killed at blossoming time. Taken July 3, 1925. Note microconidial sporodochia in diseased culms. Nat. size. C. U. Pl. Path. Herb. *14753*.

Fig. 12. Sclerotia in culms of *Carex prairea;* three exposed by splitting the culms. Note striate markings. Microconidial sporodochia in culm at left. Taken Sept. 1, 1925. Nat. size. C. U. Pl. Path. Herb. *14946*.

Fig. 13. Apothecia arising from long truncate sclerotia in the water of the swamp. At right sclerotia still enclosed in the old culms. Nat. size. C. U. Pl. Path. Herb. *11516* and *10544*.

PLATE 5

Cultural Characters of *S. Duriaeana* and *S. longisclerotialis*

Fig. 14. Sclerotia of *S. Duriaeana* formed on potato agar. Culture 6 weeks old. Surface of sclerotium next the glass, pink. From culms of *Carex prairea*. Half nat. size. C. U. Pl. Path. Herb. *14947*.

Fig. 15. Sclerotia of *S. Duriaeana* formed on potato agar. Culture 6 weeks old; from culms of *Carex stricta*. Half nat. size. C. U. Pl. Path. Herb. *14747*.

Fig. 16. Typical growth of *S. Duriaeana* from *C. stricta* on potato agar; single ascospore plantings; 13-day-old culture. Half nat. size. C. U. Pl. Path. Herb. *11515*.

Fig. 17. Culture of *S. Duriaeana* from *C. stricta;* mycelial transfer on potato agar; about 6 weeks old. Note the large black sclerotia; also the microconidial masses forming at margins of the colonies. Colony at upper right of plate contaminated by bacteria. Half nat. size. C. U. Pl. Path. Herb. *14747*.

Fig. 18. Original culture of *S. Duriaeana* from bits of diseased culm of *C. stricta* disinfected and planted in potato agar. Photographed by transmitted light. Note the short dark bits of culms and the large sclerotia; also the microconidial masses fringing the margins of the colonies. Half nat. size. C. U. Pl. Path. Herb. *14747*.

Fig. 19. Fifteen-day-old culture of ascospore sowings of *S. Duriaeana* from *C. stricta* on potato agar. Note the microconidial masses. Half nat. size. C. U. Pl. Path. Herb. *11515*.

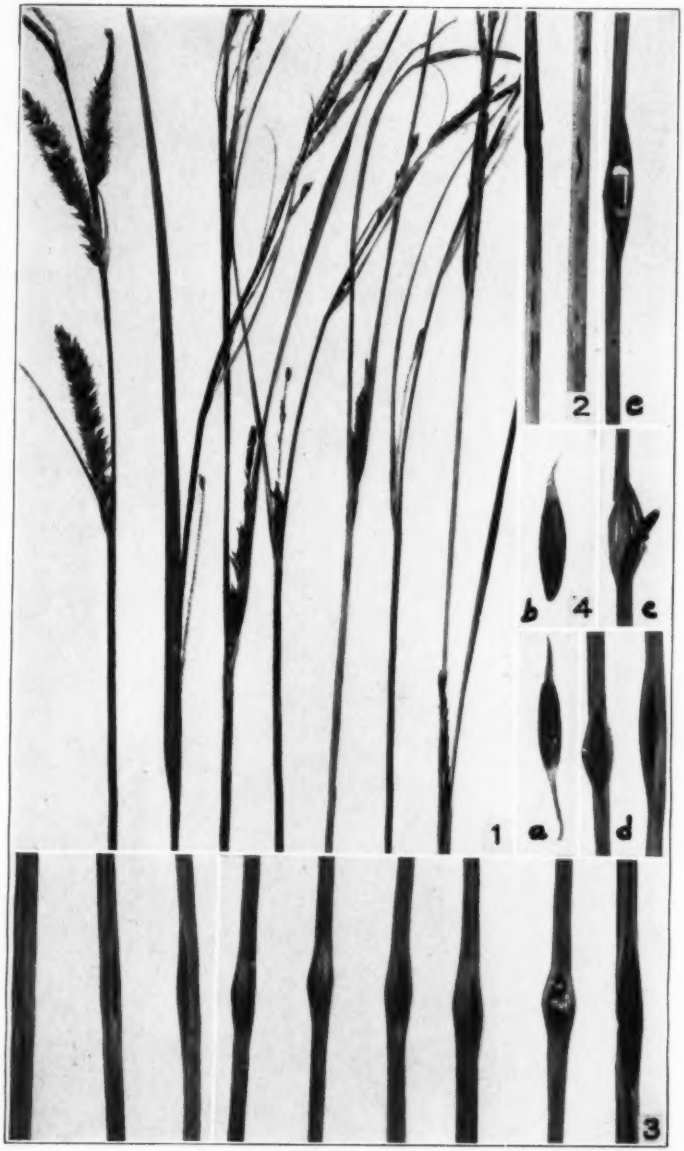
Fig. 20. Culture of *S. longisclerotialis* from *Carex prairea;* ascospore sowings on potato agar, 13 days old. Typical growth on this media. Half nat. size. C. U. Pl. Path. Herb. *11516*.

Fig. 21. Culture of *S. longisclerotialis* from *Carex prairea;* ascospore sowing on potato agar. Note absence of sclerotia and abundance of microconidial masses along margin of the slant. Half nat. size. C. U. Pl. Path. Herb. *14179*.

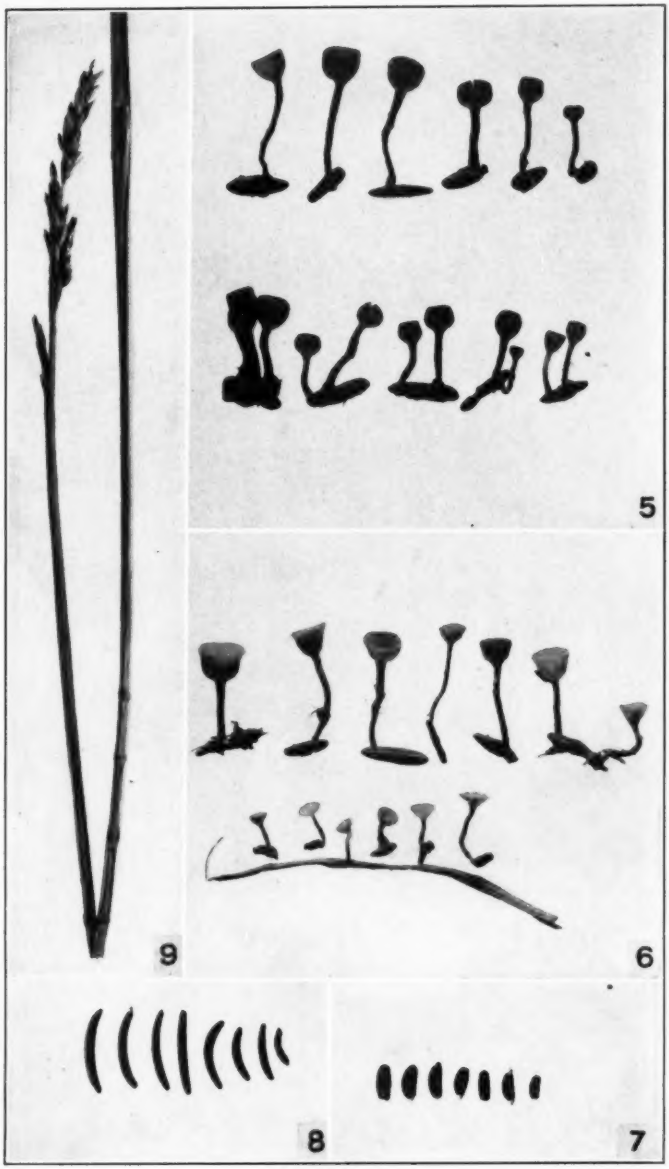
Fig. 22. Potato agar culture of *S. longisclerotialis* from *Carex prairea* showing formation of microconidial masses along margin of slant. Half nat. size. C. U. Pl. Path. Herb. *17046*.

PLATE 6

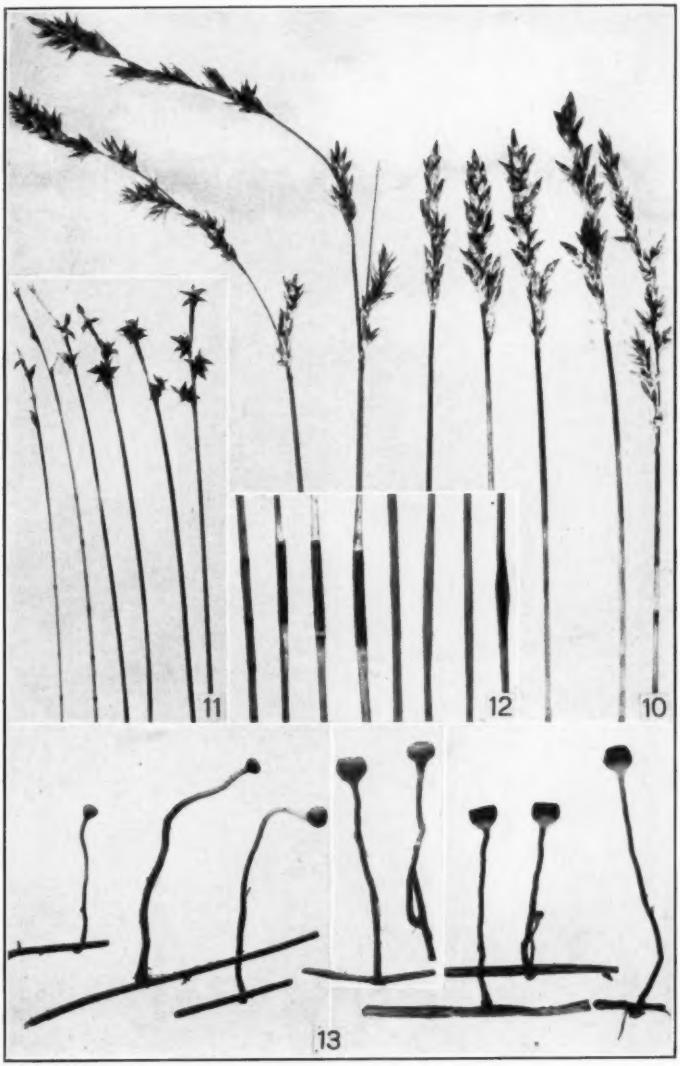
Fig. 23. Cross-section through sporodochium of *S. longisclerotialis* in culm of *Carex prairea*. Camera lucida drawing; about × 340. C. U. Pl. Path. Herb. *14946*.



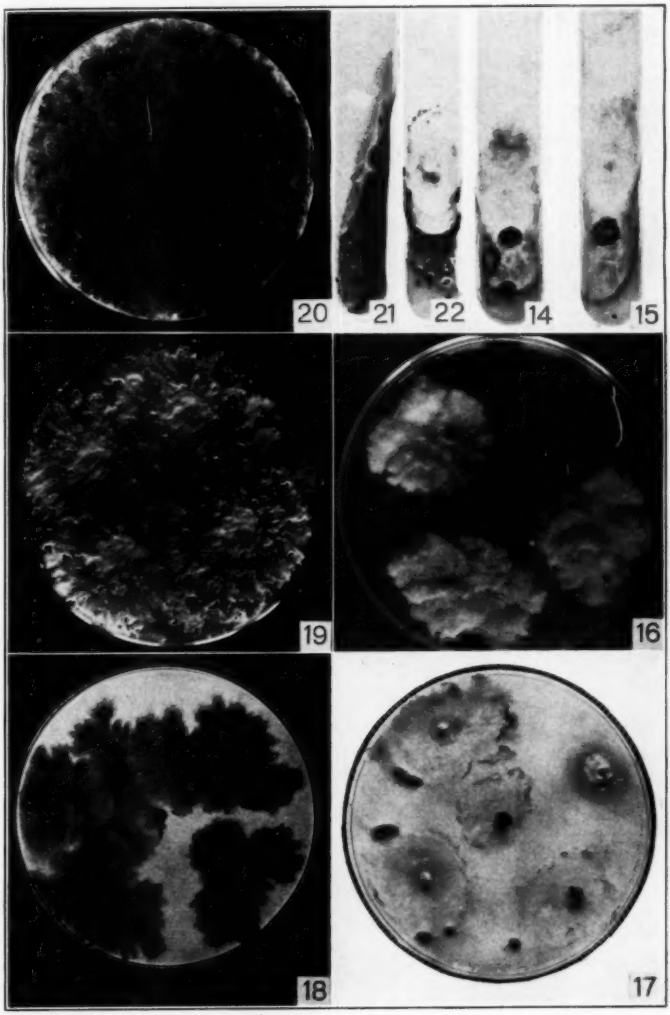
SCLEROTINIA



SCLEROTINIA



SCLEROTINIA



SCLEROTINIA

SCLEROTINIA

NEW SPECIES OF LICHENS FROM PORTO RICO. II [1]

E. A. VAINIO

[As stated in the previous paper 52 specimens of the Portorican lichens were submitted to Doctor Vainio for study. The new species described below are the result of his work on these specimens. The types are in Doctor Vainio's herbarium.]

1. **Lecanora chlorophaeiza** Vainio (n. sp.).

Sporis tenuioribus, disco apotheciorum testaceo-rufescenti et margine tenuiore a *L. chlorophaeode* Nyl. differt. Sporae long. 10–12, crass. 4–4.5 μ. Saxicola.

On rocks in an open field near Aibonito at 2200 ft., Fink *1939*.

2. **Pertusaria mastocheila** Vainio (n. sp.).

Thallus extus intusque KHO lutescens vel subfulvescens, verruculis minutissimis inspersus albidus. Pseudostromata albida, sat crebra, simplicia aut fortuito 2 confluentia, lat. 0.6–8 mm, nonnullis gibbis lateralibus instructa basi, constricta, vertice leviter impresso, sed disco nigricante saepe demum gibbum leviter prominentem formante, KHO extus parum reagentia, intus fulvescentia et demum partim leviter subrubescentia. Corticola.

On bark in an open field near Naranjito, Fink *218*.

3. **Buellia yaucoënsis** Vainio (n. sp.).

Thallus albido-glaucescens, nec KHO nec $CaCl_2O_2$ reagens, sat tenuis, laevigatus aut leviter verruculoso-inaequalis, hypothallo indistincto. Apothecia sat crebra, lat. 0.5–0.3 mm, disco demum convexo, nigro, nudo, opaco, margine nigro, tenuissimo, demum excluso. Epithecium fuscescens. Paraphyses sat laxe cohaerentes, apice anguste clavatae. Hypothecium sordide pallidum, partim dilute fuscescens, inferne sordide diluteque rubescens, hyphis erectis. Perithecium gonidiis destitutum, extus fuscescens, intus sordide pallidum. Sporae 8:nae, ellip-

[1] Number 1 of this series was published by Professor Bruce Fink in Mycologia **19:** 206–221. The present was transmitted through the Botany Department of Miami University, Oxford, Ohio, by Joyce Hedrick.

soideae oblongaeve, apicibus rotundatis, rectae aut rarius curvatae, septo sat tenui, membrana aequaliter modice incrassata, long. 10–16, crass. 5–7 μ, fuscescentes. Lignicola.

On old logs on an exposed hilltop near Yauco, Fink *1460*.

4. **Collemopsidium atlanticum** Vainio (n. sp.).

Thallus tenuis, partim subcontinuus, partim dispersus, sat laevigatus, fusco-nigricans, opacus, in lamina tenui fulvo-fuscescens. Apothecia circ. 0.15–0.2 mm lata, verrucas nigras formantia, disco punctiformi, nigro, saepe concavo vel leviter impresso, margine tenuissimo, nigro. Perithecium fusco-fuligineum, integrum, gonidiis destitutum. Hypothecium parte superiore fuscescens. Hymenium 80–90 μ crassum. Epithecium decoloratum pallidumve. Paraphyses arcte cohaerentes. Asci clavati aut subventricosi. Sporae 8:nae, distichae, decolores, ovoideo-oblongae, 1-septatae, haud constrictae, long. 15–17, crass. 5 μ. Gonidia gloeocapsoidea, cavitate rotundata, diam. 10–8 μ. Calcicola.

On rocks on an exposed hilltop near Yauco, Fink *1402* (type).

5. **Finkia portoricensis** Vainio (n. gen. et n. sp.).

Thallus crustaceus, sat tenuis aut modice incrassatus, rimosus vel diffractus, sat laevigatus aut leviter inaequalis, pallidus vel cinereo-pallescens, KHO non reagens. Apothecia demum prominentia, gyalectoidea, lat. 0.2 mm, disco testaceo rufescenteve, impresso, margine prominente, concolore aut raro fuscescente. Perithecium extus testaceum rufescensve, intus pallidum, gonidiis destitutum, plectenparenchymaticum, membranis sat tenuibus, conglutinatis, cavitatibus parvis. Hypothecium decoloratum. Epithecium decoloratum. Hymenium iodo non reagens (exsiccatum rubescens). Paraphyses gelatinosae, cavitatibus 1 μ latis. Sporae 8:nae-binae, decolores, oblongae ellipsoideaeve, murali-divisae, long. 24–27, crass. 12 μ. Gonidia gloeocapsoidea, globosa aut subglobosa, diam. 10–7 μ, membrana decolore, modice incrassata, chromatophoro glaucescente aut raro aeruginoso-virescente. Saxicola.—Gen. *Finkia* thallo crustaceo, gonidiis gloeocapsoideis, perithecio gonidiis destituto et sporis muralibus distinguitur.

On rocks along an open roadside near Mayaguez, Fink *1286* (type).

6. **Bacidia millegrana epichlorella** Vainio (n. subsp.).

Epithecio aeruginoso-fuligineo aut partim olivaceo a *Bacidia subluteola* (Nyl.) differens. Thallus albidus, hypothallo nigro.

Apothecia disco nigricante, nudo. Perithecium decoloratum. Hypothecium fuscum aut fulvofuscescens, fulvescensve. Sporae aciculares, long. 50–83, crass. 2.5–4 μ, septis usque ad 11. Corticola.

On bark in woods near Aibonito, Fink *1755*.

7. **Bacidia tristis** Vainio (n. sp.).

A *B. Lafayetteana* Vainio (Lich. Bras. Exs. n. 295) sporis brevioribus differens. Thallus verruculoso-inaequalis, cinereo-glaucescens. Apothecia sat crebra, lat. 0.5–0.3 mm, late adnata, KHO non reagentia, disco plano, demum convexo, fuscescente aut p.p. rufescente, nudo, opaco, margine concolore, sat tenui, haud prominente, persistente aut demum excluso. Hypotheçium superne rufescens, inferne pallidum. Perithecium extus pallidum, intus rufescens aut in margine fere totum rufescens. Hymenium circ. 60 μ crassum, decoloratum aut epithecio pallido, iodo caerulescens. Sporae aciculares rectae, pauciseptatae, long. 25–28, crass. 2–2.5 μ. Gonidia simplicia, diam. 5–13 μ, membrana sat tenui. Corticola.

On bark in woods near Naranjito, Fink *351* (type).

8. **Bilimbia Finkii** Vainio (n. sp.).

Thallus sat tenuis, laevigatus aut leviter verruculoso-inaequalis. Apothecia crebra et partim confluentia contiguave, lat. 0.5–0.3 mm, tenuia, late adnata, testacea, haud pruinosa, margine tenuissimo, concolore, subpersistente. Perithecium pallidum aut intus decoloratum, plectenparenchymaticum, cavitatibus cellularum 4–10 μ latis. Hypothecium pallidum, hyphis suberectis. Hymenium 40–50 μ crassum, iodo caerulescens. Epithecium pallidum. Paraphyses arcte cohaerentes, parum gelatinosae. Sporae 8:nae, distichae, decolores, fusiformes aut ovoideo-fusiformes, apicibus acutis obtusisve, rectae, 3-septatae, long. 11–13, crass. 3 μ. Gonidia subellipsoidea globosave, diam. 6–10 μ, simplicia, membrana sat tenui. Lignicola.

On posts in an open field near Rio Piedras, Fink *534* (type); near Aibonito, Fink *1928*.

9. **Lecidea** (*Biatora*) **manatiensis** Vainio (n. sp.).

Thallus indistinctus, calci substrati immixtus, macula albida aut subglaucescente indicatus. Apothecia dispersa, lat. 1–0.7 mm, elevata, praesertim primum subturbinata, basi angusta, disco plano, demum saepe convexo, fusco aut cinereo-rufescente, opaco, nudo, margine modice incrassato, haud aut parum

prominente, concolore aut pallidiore, saepe demum excluso. Perithecium plectenparenchymaticum, cavitatibus 8–10 μ latis, extus pallescens, intus rufescens. Hypothecium rufescens, KHO non reagens, parte inferiore decoloratum et leviter myelohyphicum (hyphis haud conglutinatis), sed gonidiis destitutum. Hymenium 90–110 μ crassum, iodo caerulescens. Epithecium rufescens, KHO non reagens. Paraphyses arcte cohaerentes. Sporae 8:nae, distichae, decoloratae, oblongae, simplices, long. 10–15, crass. 5–7 μ. Gonidia globosa, diam. 7–9 μ, membrana sat tenui. Calcicola.

On rocks in an open field near Manati, Fink *2037*.

10. **Lecidea hilariella** Vainio (n. sp.).

A *L. granulosa* (Ehrh.) Ach. var. *hilari* (Nyl.) apotheciis pallido-cinerascentibus minoribusque et soraliis rotundatis leviter differt, et forsan non autonoma species. Thallus verruculosus, cinerascens et impure albidus, soraliis circ. 0.5(–1) mm latis, crebris instructus, KHO cum $CaCl_2O_2$ intus rubescens. Apothecia lat. 0.5–0.8 mm, basi leviter constricta, disco pallido-cinerascente aut p.p. subtestaceo, nudo, plano aut demum convexo, margine vulgo pallido, modice incrassato, primum prominente, subpersistente. Hypothecium albidum aut p.p. pallido-subrubricosum, ex hyphis suberectis formatum. Hymenium circ. 35 μ crassum. Epithecium pallido-fulvescens, granulosum, KHO non reagens. Paraphyses arcte cohaerentes. Sporae 8:nae, distichae, decolores, simplices, ellipsoideae, long. circ. 8, crass. 3.5 μ. Gonidia pleurococcoidea. Corticola.

On bark in an open field near Mayaguez, Fink *1237*.

11. **Gyrocollema scyphuliferum** Vainio (n. gen. et n. sp.).

Thallus calci substrati immixtus, macula albido-glaucescente indicatus. Apothecia sat crebra, adnata, basi parum constricta, lat. 0.5–0.3 mm, bene urceolata, disco profunde impresso, margine bene elevato, modice incrassato, integro, nigro. Perithecium rubricoso-fuligineum, hyphis sat leptodermaticis, conglutinatis. Hypothecium parte inferiore fuscescens aut pallido-fuscescens, superne anguste pallidum. Hymenium circ. 75 μ crassum, iodo persistentes caerulescens. Epithecium fuscescens, KHO non reagens. Paraphyses arcte cohaerentes, ramoso-connexae. Sporae 8:nae, distichae, decolores, ellipsoideae oblongaeve, apicibus obtusis, simplices, long. 8–12, crass. 3–7 μ. Gonidia nostocacea, cellulis aeruginosis, concatenatis et saepe etiam simplicibus, globosis aut ellipsoideis, long. 3–7, crass. 3–6 μ, membrana inconspicua, strato gelatinoso haud evoluto, hetero-

cystis nullis. Calcicola.—Apothecia facie externa fere sicut in *Gyrostomo scyphulifero*.—Genus *Gyrocollema* Vainio gonidiis nostocaceis, perithecio lecideino, paraphysibus ramoso-connexis, sporis simplicibus et thallo crustaceo, calci immixto, distinguitur et ad Collemaceas pertinet.

On rocks on an exposed hilltop near Yauco, Fink *1563*.

12. **Lecanactis melanocheiloides** Vainio (n. sp.).

Thallus tenuis, sat laevigatus aut levissime verruculoso-inaequalis, glaucescens. Apothecia dispersa, lat. 1–1.5 mm, late adnata, basi leviter constricta. Hypothecium et perithecium fuscofuliginea. Hymenium 110–130 μ crassum, iodo pulchre vinose rubens (haud caerulescens). Epithecium pallidofuscescens vel subrubricosum. Paraphyses parce ramoso-connexae, apices versus sensim incrassatae et abundanter subdichotome ramosae, ramis intricatis. Sporae 8:nae, polystichae, fusiformi-vel aciculari-subbacillares, decoloratae, septis 13–19, membrana leviter incrassata, in KHO turgescente, long. 46–66, crass. 5–7 μ. Gonidia chroolepoidea, crass. 8 μ. Corticola.

On bark in woods near Mameyes, Fink *768*.

13. **Arthoniactis gibbosa** Vainio (n. sp.).

Thallus calci substrati immixtus, macula albido- aut subfumoso-cinerascente indicatus. Apothecia dispersa, adnata, basi haud aut parum constricta, lat. 0.5–0.7 mm, nigra, nuda, KHO non reagentia, disco plano, vulgo papillato, margine prominente, modice incrassato, crenulato verruculosove. Perithecium fuscofuligineum. Hypothecium fuscescens. Hymenium 75–70 μ crassum, iodo non reagens. Paraphyses increbre ramoso-connexae, crass. 1–1.5 μ, apicem versus saepe sensim incrassatae (–3 μ), apice simplices aut subsimplices, arcte cohaerentes. Sporae 8:nae, ovoideo-oblongae, 1-septatae, long. 20–24, crass. 7–10 μ, decolores (demum saepe morbose nigricantes). Calcicola. —Genus *Arthoniactis* (Vainio, Cat. Welw. Afr. Lich. p. 430) sporis 1-septatis a *Lecanactide* differt.

On rocks on an exposed hillside near Yauco, Fink *1636*.

14. **Thelotrema** (*Brassia*) **pauperculum** Vainio (n. sp.).

Thallus sat crassus, verrucoso-rugosus, stramineo-glaucescens, KHO demum rubescens. Apothecia thallo immersa, partim crebre aggregata, disco punctiformi, circ. 0.05 mm lato, fuscescente, leviter aut haud impresso. Parathecium tenue, fuscescens. Columella haud evoluta. Epithecium fuscescens. Sporae 8:nae,

distichae, decoloratae, ellipsoideae, septis transversis 3–5, demum loculis 1–3 bicellulosis (submurales), membrana sat crassa (crassit. 15 μ), iodo caeruleo-violascentes, long. 16–22, crassit. 9–13 μ. Facie externa subsimile *T. terebrato*, sed sporis submuralibus ab eo differens. Corticola.

On bark in woods near Rio Piedras, Fink *519*.

15. **Thelotrema** (*Leptotrema*) **compunctum** (Sm.) Nyl. f. **portoricensis** Vainio (n. f.).

Parathecio albido instructa. Sporae long. 25–36, crass. 9–16 μ. Corticola.

On bark on an exposed hilltop near Aibonito, Fink *1749*.

16. **Thelotrema** (*Ocellularia*) **alboolivaceum** Vainio (n. sp.).

Thallus tenuis, continuus, verruculis minutissimis, leviter prominentibus inspersus, olivaceus, KHO demum rubescens, leviter nitidus. Apothecia lat. 0.8–0.5 mm, prominentia, latere praerupto, disco albido-pruinoso, margine prominente, albo, saepe duplice, margine interiore fissura a margine exteriore disjuncto, tenuissimo, ostiolo circ. 0.5 mm lato. Perithecium pallidum decoloratumve. Columella haud evoluta. Sporae 8:nae, distichae, decoloratae, iodo violascentes, subfusiformes, apicibus obtusis aut raro acutis, 3-septatae, long. 16–19, crass. 5–6 μ, haud gelatinosae. Corticola.—Facie externa subsimile est *T. porinoidi* Mont. (*T. bicavato* Nyl.), sporis minoribus ab ea differens.

On bark in woods near Vega Baja, Fink *2153*.

17. **Thelotrema** (*Ocellularia*) **subcrassulum** Vainio (n. sp.).

Vix nisi sporis iodo violascentibus a *T. Crassulo* Nyl. differt, quae nota in hoc genere est constans (quoad sporas maturas). Thallus stramineo-glaucescens, nec iodo nec KHO reagens (post tempus longius subrufescens), vix distincte verruculis minutissimis inspersus, nitidus, sat crassus. Apothecia crebra, thallo immersa, margine ostiolari haud prominente, saepe leviter impresso, ostiolo minutissimo, circ. 0.05 mm. lato. Perithecium albidum. Columella haud evoluta. Epithecium albidum. Sporae 8:nae, distichae, decoloratae, iodo violescentes, oblongae, apicibus obtusis rotundatisve, 3-septatae, loculis apicalibus interdum majoribus, long. 11–14, crass. 4.5–5 μ. Corticola.

On bark in woods near El Yunque at 3000 ft., Fink *725* (type).

18. **Bottaria** (*Anthracothecium*) **libricola** (Fée) Vainio, Jour. Bot. **34:** 265. 1896. f. **nana** Vainio (n. f.).

Apothecia substrato thalloque immersa, tantum ostiolo minutissimo indicata. Corticola.

On bark on an exposed hilltop near Yauco, Fink *1669* (type). Near Vega Baja, F. L. Stevens *2491*. Algal host *Trentepohlia*.

19. **Pyrenula atrofuscescens** Vainio (n. sp.).

Thallus sat crassus, modice incrassatus, epiphloeodes, laevigatus, fuscescens, sat opacus, rimosus, hypothallo indistincto. Apothecia crebra, verrucas conoideo-hemisphaericas, circ. 0.5 mm latas formantia. Perithecium fuligineum, conoideo-hemisphaericum, fuligineum, basi tenue, latere circumcirca angulosum (haud alatum), parte inferiore strato thallino obductum, vertice late denudato. Sporae 8:nae, fusiformi-oblongae, apicibus obtusis, lateribus convexis, fuscescentes, haud gelatinosae, papillis apicalibus nullis, 3-septatae, loculis apicalibus minoribus, long. 18–21 (–16), crass. 8–10 μ. Corticola.—Proxima *P. atropurpureae* (Eschw.) Müll. Arg. (Flora **67:** 665. 1884) etiam sec. specim. orig. in herb. Nyl.

On bark in an open field near Rio Piedras, Fink *504*. Algal host *Trentepohlia*.

20. **Porina subprospersella** Vainio (n. sp.).

Thallus calci immixtus. Apothecia crebra numerosissimaque, lat. 1–1.5 mm, omnino aut parte inferiore substrato immersa, nigra. Perithecium dimidiatim fuligineum. Nucleus decoloratus, iodo non reagens. Paraphyses simplices, crass. 1 μ. Asci cylindrici, membrana sat tenui etiam in apice, long. 70–100, crass. 10–12 μ. Sporae 8:nae, distichae aut subdistichae, fusiformi-oblongae aut subovoideo-fusiformes, decoloratae, 1-septatae, long. 16–21, crass. 3–5 μ. Gonidia trentepohliacea, crass. 10–13 μ, membrana sat tenui. Calcicola.—Habitu subsimilis est *Arthopyreniae prospersellae* (Nyl.).

On limestone on an exposed hilltop near Yauco, Fink *1398* (type). Near Frujilla Alta, Britton *8663*, *8665*.

21. **Arthopyrenia leptosporiza** Vainio (n. sp.).

Thallus sat tenuis, verruculoso-areolatus aut sat continuus, terra ochracea pallide ochraceo-tinctus, opacus. Apothecia crebra, thallo immersa, vertice nigro vix 0.1 mm lato denudato, haud aut levissime prominente. Perithecium fuscum, basi

albidum. Nucleus albidus, iodo non reagens. Paraphyses parcae, parce ramoso-connexae. Asci subcylindrici aut subventricoso-cylindrici, long. 45–50, crass. 10–13 μ, in apice membrana modice incrassata. Sporae 8:nae, distichae, decoloratae, ovoideo-oblongae, haud aut levissime constrictae, 1-septatae, long. 14–17, crass. 3–4 μ. Gonidia trentepohliacea, cellulis p.p. concatenatis, 6–9 μ crassis. Thallo ab. *A. fluctigena* Nyl. differt. Terricola.

On moist soil near Yauco, Fink *1753*.

22. **Mycoporum integrum** Vainio (n. sp.).

Thallus sat tenuis, verruculis et granulis soredioideis inspersus, opacus, albido-glaucescens. Apothecia sat crebra, rotundata aut irregularia, lat. circ. 0.2–0.3 (–0.4) mm, parum prominentia, fusconigra, nuda. Perithecium integre, fusco-fuligineum. Nucleus iodo non reagens. Asci ventricosi, long. 90–92, crass. 42–45 μ. Sporae 8:nae, decoloratae, murali-divisae, septis transversis 7, medio constrictae, haud gelatinosae, long. 30–33, crass. 13–14 μ. Gonidia globosa, diam. 6–7 μ, tantum simplicia visa, membrana sat tenui. Corticola.—Facie externe subsimile *M. pyrenocarpo* Nyl.

On bark near Aibonito, Fink *1800*. Algal host *Palmella*.

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IS PSALLIOTA BRUNNESCENS UNDER CULTIVATION?

F. C. Stewart

(With Plates 6 and 7)

Some brick spawn used in mushroom beds under the benches of a greenhouse at the New York Agricultural Experiment Station was obtained from an "old and reliable" firm of seedsmen in New York City. It was purchased as "American spore culture mushroom, cream white variety."

All of the mushrooms produced from this spawn were altogether different from the common mushroom, *Psalliota campestris*. They were reddish-brown, fibrillose-scaly, and usually of large size. Being unable to determine the species, we sent specimens to Dr. C. H. Kauffman, Ann Arbor, Michigan, for identification. After a careful study of the plants Dr. Kauffman expressed the opinion that they belonged to *Psalliota brunnescens*, a species described by Peck (**4**) in 1900.

This identification is necessarily uncertain, because, as stated by Duggar (**1**), the cultivated form of a mushroom may be quite different from its wild form. In a letter dated April 26, 1926, Dr. Kauffman says: "Of course it may not be *P. brunnescens*, but I know of no other species to which it can approach so closely. It certainly should not be considered a variety of *P. campestris*, *P. arvensis*, or *P. subrufescens*, unless cultivation of agarics causes more far-reaching changes than any known in plants and due to cultivation of this kind."

It should be noted here that Murrill (**3**) once wrote as follows concerning *Psalliota brunnescens:* "My *A[garicus] campester hortensis* described and figured in Mycologia for July, 1914, seems very near this species." Previously, Murrill (**2**) had stated that his variety is "often cultivated but is rarely found wild."

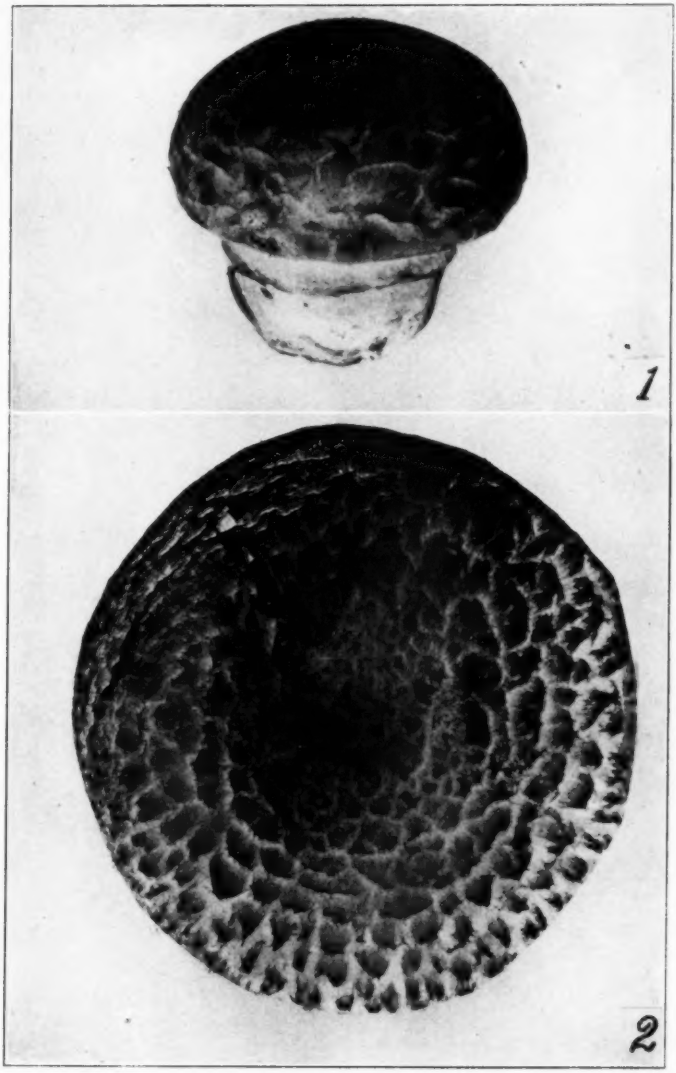
Our fungus is characterized as follows: *Pileus* 5–12 cm. broad, convex to convex-expanded, firm, dry, reddish-brown, fibrillose-scaly, margin at first incurved and surpassing the lamellae;

flesh thick, compact, white, unchanging or becoming slightly rufescent when broken; *lamellae* crowded, free but reaching the stipe, rounded behind or truncate from pressure against the stipe, often appearing adnate, narrow, lanceolate, often forked, at first whitish or pallid, then pink and finally brown, on the edge whitish and minutely uneven due to numerous tufts of clavate, hyalin, sterile cells; *stipe* 3–6 cm. long, 2.5–4.5 cm. thick, tapering downward, or largest at the annulus, silky, white within and without, becoming rufescent when bruised or cut below the annulus, solid or persistently stuffed, rarely with a small hollow; *veil* thick, forming a tumid annulus, double, outer layer sheathing the base or lower half of the stem, the two layers quite concrete with each other, tinged like the flesh or becoming "fawn" (R) color in age; *annulus* median, persistent, up to 5–6 mm. thick in the early tumid condition, flaring upwards at first, frequently striate on the upper surface, veil-remnants often left on the appendiculate margin of the pileus, forming a thick striate rim; *spores* broadly elliptical, 4–6 × 6–8 μ, purple-brown; basidia 2-spored; *taste* of fresh mature plant slightly disagreeable. Edible.

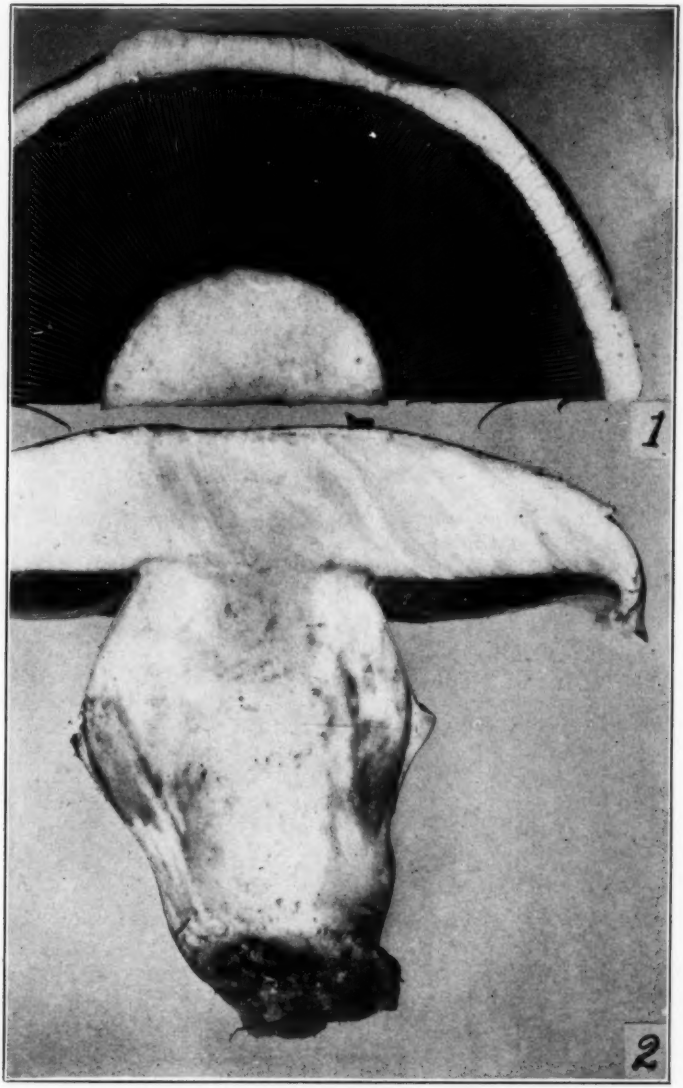
The average weight of the plants was 86.7 gms. Several of the larger ones weighed over 200 gms. each. In cross-sections of the stipe made below the annulus a small circular area at the center remains white while the remainder promptly becomes rufescent. Plants placed in formaldehyde solution promptly give the solution a reddish-brown color. Peck states that plants of *Psalliota brunnescens* frequently develop fully beneath the surface of the ground. None of our plants have done this.

The lamellae often contained brown hyphae belonging to some other fungus. These were readily demonstrated by a microscopic examination of pieces of lamella which had been placed in water under a coverglass on a glass slide and crushed thin by gentle pressure on the coverglass. They were usually 8–10 μ in diameter, simple or sparingly branched, sinuous, and with but few cross-walls. When simple their course of direction was usually at right angles with the edge of the lamella.

Often they could be traced clear across the field of the microscope. No sign of fructification was observed in connection with them. It was found easy to detect them in the lamellae of dried



PSALLIOTA BRUNNESCENS (?)



PSALLIOTA BRUNNESCENS (?)

specimens as well as in fresh material. This phenomenon is quite new to the writer, but Dr. Kauffman informs us that he has observed similar brown hyphae in the lamellae of other agarics.

Psalliota brunnescens is rare in the wild state and we have found nothing in the literature, except Murrill's suggestion above mentioned, to indicate that it is under cultivation by mushroom growers. Accordingly, it would be of interest to know how our plant got into cultivation, but all that we have been able to learn about it is that the spawn which we used was prepared by the American Spawn Company, St. Paul, Minnesota.

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION,
GENEVA, N. Y.

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2. **Murrill, W. A.** Dark-spored agarics—III. Mycologia **14**: 212. 1922.
3. ——. Illustrations of fungi—XVIII. Mycologia **6**: 166. 1914.
4. **Peck, C. H.** New species of fungi. Bull. Torrey Club **27**: 16. 1900.

EXPLANATION OF PLATES

Psalliota brunnescens Peck (?) grown from commercial brick spawn in mushroom beds in a greenhouse. All figures natural size. From photographs by W. O. Gloyer.

PLATE 6

Fig. 1. A "button."
Fig. 2. Surface view of the pileus of a mature plant.

PLATE 7

Fig. 1. The hymenium and a cross-section of the stipe.
Fig. 2. Longitudinal section of a mature plant.

A COMPARISON OF TWO SPECIES OF PLECTODISCELLA

A. E. Jenkins and J. G. Horsfall

(With 2 Text figures)

Osterwalder (**7**) at the Wädenswil Experiment Station in Switzerland has recently reported upon a fungus which he isolated from small flecks on fruits of the Jonathan apple[1] and which he considered to be Jonathan spot; this fruit spot was brought to his attention by Dr. Zschokke, at the same Institution, who had earlier referred to it in a horticultural description of this apple variety. Osterwalder's observations of the fungus did not permit of its classification. A culture of this fungus, contributed through the kindness of Dr. Osterwalder, shows, in general, the distinctive morphological characters of the genus *Plectodiscella* as exemplified by *P. veneta*. Chiefly on this basis and that of certain other related information the Osterwalder fungus, for which fruiting forms had not previously been observed, is now assigned to an ascomycetous species, namely *Plectodiscella Piri* of the family Plectodiscelleae. This classification was established in 1914 by the Russian investigator, Woronichin (**8**), in order to designate an ascomycetous fungus which he had discovered previously in Transcaucasia. As he observed it the fungus caused a small leaf spot on foliage of unnamed varieties of both cultivated apple (*Malus*) and pear (*Pyrus*).

Plectodiscella veneta is the only fungus other than the type to have been classified in this family and genus. Both species have since been included by Arnaud (1) in the *Elsinoe* Section of the genus *Uleomyces* but the basis for this classification will not be considered at this time. In this section Arnaud (1) also lists *E. viticola* Rac., which is suggestive of a possible perfect stage of *Sphaceloma ampelinum* de Bary (3) referred to below.

[1] Neither of the authors is very familiar with the Osterwalder fruit spot or the Jonathan spot, and therefore neither is in a position to express an opinion as to their identity.

IDENTITY OF THE OSTERWALDER FUNGUS WITH PLECTODISCELLA PIRI

Woronichin (**8**) published a detailed description of *Plectodiscella Piri* with illustrations showing the development of its ascomycetous stage on leaves of apple or pear. Osterwalder's (**7**) article contains a careful description of all the characters of the apple fruit spot fungus as he observed them. However, unless Osterwalder were especially interested in the genus *Plectodiscella*, it would not be expected that he would have noted the identity of the Swiss fungus, fruiting forms of which were unknown, with an ascomycetous fungus which had been reported as occurring not on the fruits but on the leaves of the apple as well as on those of the pear.

A contribution of specimens from the type material of *Plectodiscella Piri* was made to the senior author in June, 1926, through the kindness of Dr. N. N. Woronichin and Dr. A. A. Jaczewski. A morphological comparison of the fungus on these specimens with the Osterwalder culture, together with the information contained in the two articles just cited, and as herein reviewed, confirms the opinion that the Osterwalder fungus is identical with *P. Piri*. An illustration of the leaves of apple and pear constituting a part of the specimens received from Russia is shown in Figure 1. It is thought important to state that in addition to mycelial growth and asci described by Woronichin a mass of unattached conidia was seen in a preparation from one of these specimens. These were similar to the conidia which, as mentioned later, were obtained in the culture of the Osterwalder fungus. Macroscopically, the culture received from Osterwalder agreed in every respect with his detailed description and illustrations of the organism obtained by him from the fruit spot on apples from Switzerland.

The conidial stages of *Plectodiscella Piri* Wor. (**8**) and of *P. veneta* Burk. (**4**), as observed in culture by the authors, and the conidial stage of *P. veneta*, as pictured or described in the earlier literature, are as correspondingly similar as are the original descriptions and illustrations of their perfect stages. By comparing the gross cultural characters of the Osterwalder fungus with those of cultures of *P. veneta*, of which one strain was

contributed by L. K. Jones (**5**) and the others isolated by one of the authors, the two are easily distinguished although they are so nearly alike that either one could be employed interchangeably

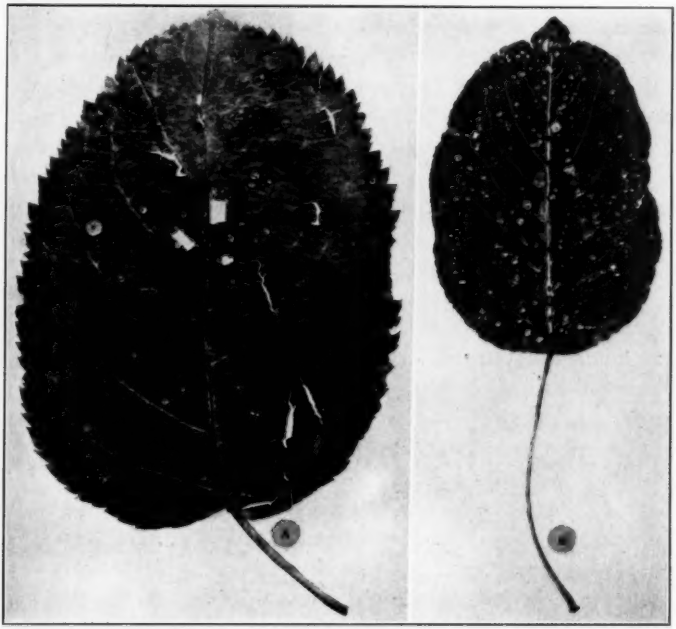

FIG. 1. *Plectodiscella Piri* Wor. on leaves of apple (A) and on pear (B) gathered by Woronichin in Transcaucasia, Russia, August, 1919. Photo graph by W. R. Fisher.

as representative of the genus *Plectodiscella*. On the basis of the available information there would then seem to be no question but that the Osterwalder fungus belongs to this genus, and evidently represents the type species. There remains the possibility, of course, that it may be varietally different from *P. Piri* as it occurs in Russia. Even if cultures from Russia were available, considerable detailed investigation would doubtless be required before much additional definite information bearing on this point could be obtained.

In culture the Osterwalder fungus is not only similar to

Plectodiscella veneta, which, as recently demonstrated (**5**) in its vegetative characters is referable to the form genus *Sphaceloma* de Bary (**3**), but is also equally like to the other forms of *Sphaceloma* which have been studied by the writers (**2**, **5**, **6**), among which may be named *S. ampelinum* de Bary, *S. fawcettii* Jenkins, *S. symphoricarpi* Barrus & Horsfall, and a species as yet undescribed, occurring on the avocado (*Persea*), as well as a *Sphaceloma* occurring on the rose (*Rosa*[2]) which has not yet been definitely determined.

DESCRIPTIVE ACCOUNT

Osterwalder's (**7**) description of the fruit spot with which this fungus is associated is as follows:[3] "The fruit spot is confined chiefly to the blush side of the Jonathan apple, which is often entirely dotted with 50 or more small, punctiform, round, smooth, shining spots about 2 mm. in diameter. A lenticel forms the center of the spot, the lesions being scarcely more than colored regions of the skin penetrating a small number of cell layers, usually about seven, and presenting a brown appearance." Woronichin (**8**) describes the spot as occurring "on the upper side of the leaf and consisting of a light gray center with a brownish border. They are round, 1–2 mm. in diameter or oval up to 2–4 mm. Adjacent spots seldom unite."

Osterwalder's (**7**) description of the morphology and development of the vegetative growth of the fungus in these small discolored areas is here translated in full: "The hyphae grow between and often within the dead cells, being most numerous just below the epidermal layer. In color they are hyaline, differing in this respect from the apple scab organism (*Venturia inaequalis* (Cooke) Aderh.) and from most other parasitic fungi in that they are not cylindrical or tubular but appear as series of chains or cells of unequal diameter, in this respect bearing a resemblance to the small uneven sized bones of the fingers of a human skeleton. Between the cells of the apple, the fungus resembles somewhat the mycelium of Exoascus species in plum

[2] The writers are grateful to Prof. L. M. Massey for a culture of this fungus contributed by him in 1925, he having gathered and grown it in pure culture as early as 1923.

[3] In this Section the quotations represent more or less free translations from Dr. Osterwalder's (**7**) or Dr. Woronichin's (**8**) papers.

pockets or 'hexenbesen' of cherry trees. Its cells often contain a larger or smaller number of fat globules. Through the aperture of the lenticels the stroma may emerge, growing upward, rope-like, out of the interior of the spots, terminating in a layer of round yeast-like cells." Conidia or other propagative organs are sought for in vain.

This description compares fairly well with Woronichin's account of the ascomata in their earlier development in the leaf of apple or pear, discussed in connection with his characterization of the family Plectodiscelleae.

Osterwalder isolated the fungus from the fruit spots and noted its comparatively slow growth on both agar and gelatine media. On gelatine media he states that in the course of two or three weeks it reached a diameter of about 6 mm., being red in color at the beginning and, later, brownish black and wrinkled. He observed that about the edge of the stromatic growth on gelatine, which it liquifies to some extent, yeast-like cells or chains of unequal diameter were formed, which, with slight pressure, separate from one another and become scattered about again reproducing new colonies. For the most part these "yeast-like cells or chains" were probably recently germinated conidia or possibly in part primary or secondary conidia. Osterwalder reports the cardinal temperatures for growth of the fungus as follows: Minimal, 5°; optimal, 21°; and maximal, 29° C.

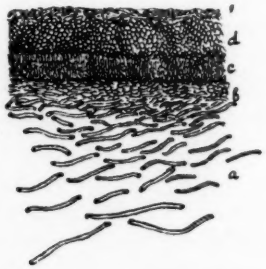

FIG. 2. *Plectodiscella Piri* Wor. Microscopic cross-section of ten-weeks-old agar culture grown at 21° C. After Osterwalder.

Osterwalder's (7) description of the fungus as it developed in the fruit spot and in culture could well be considered as in

complement to Woronichin's (**8**) description of *Plectodiscella Piri* in another phase of its development. It is of interest to note that his description and discussion of the tissue-like layers composing a microscopic section of an old agar culture of his fungus (FIG. 2), quoted below, corresponds closely with Woronichin's (**8**) somewhat similar account and discussion of the structure of the older ascomata of this fungus growing on a substratum composed of leaf tissue of the apple or pear.

A description of the cultural growth of members of the genus *Plectodiscella* or *Sphaceloma* is of prime importance for purposes of identification. For this reason Osterwalder's (**7**) description of what may now be termed the cultural growth of *Plectodiscella Piri*, typifying alike the general cultural characters of the relatively new genus *Plectodiscella* and the family Plectodiscelleae, is here quoted in full in the original.

"Auf Agar wuchs der Pilz besser als in Gelatine, und wurde auch hier zu einer vielfach gefalteten Haut, die an Nostoc-Gallerten erinnerte, umso mehr, als die Falten graugrüngelb bis kastanienbraun erschienen (Abb. 4). Nur die Randpartien weisen zunächst eine weissflaumige Beschaffenheit auf, verfärben sich aber später braunrot. Der Pilz wächst tief in das sich hiebei grünlich gelb verfärbende Agar hinein, erscheint hier auch fädig, hyalin, meist $1\frac{1}{2}$–2 μ dick. Die gefaltete Haut an der Oberfläche des Agars erinnert im Querschnitt (Abb. 5 = Fig. 2) an ein Sclerotium, unreifes Apothezium oder sonstigen Fruchtkörper eines höheren Pilzes. Nach innen in die Tiefe frei und locker wachsend (Abb. 5a), verschlingen sich die Fäden nach oben hin immer enger ineinander, bilden ein dichtes Geflecht, eine Art Subhymenialschicht oder Hypothecium (Abb. 5b). An dieses Pilzgeflecht schliesst sich dann eine feinfaserige Gewebeschicht (Abb. 5c), die wieder überlagert wird von einem pseudoparenchymatischen Gewebe (Abb. 5d), das nach und nach in Einzelfäden sich auflöst, wodurch die Oberfläche ein flaumiges Aussehen erhält. (Abb. 5e). Die Reinkulturen des Pilzes in Gelatine, namentlich aber auf Agar, erinnern im Aussehen und ihrer inneren Struktur an einen höheren Pilz. z.B. an eine Tremella. Auch in Nährflussigkeiten, z.B. einem unvergorenen Birnsaft, wuchs der Pilz nicht ausgiebig, bildete innerhalb drei Wochen bis 1 mm gross runde Flöckchen mit dünnem hyalinem Myzel, die nach weiteren vier Wochen einen Durchmesser von 2–3 mm erreichten. Ältere Fäden verfärbten sich bräunlich, beim Drucken auf das Deckglas in kürzere 1–2 zellige Fragmente zerfallend. Auch bei diesen Kulturen trat eine Sporenbildung irgend welcher Art nicht ein."

To this description may be added the fact that conidia of this fungus as observed by the authors are mostly oblong-elliptical, hyaline, often bi-guttulate. As produced in the Osterwalder culture they measured 4–9 × 1.6–2.5 μ.

For convenience in reference and to bring together in one place all available information descriptive of *P. Piri* a copy of Woronichin's (**8**) description of the ascomata of this species and of the family Plectodiscelleae is likewise quoted:

"*Plectodiscelleae* WORONICHIN (nova familia). Ascomata im Substrat lagernd, später von der deckenden Cuticula sich befreiend, eng mit der Basis an das Substrat anwachsend, meist von polsterartiger Form, welche nach den Rändern zu sich verdünnt und nicht scharf begrenzt ist, mit gut entwickeltem Epithecium-Schildchen, welches aus einreihigen polygonalen dunkelgefärbten Zellen besteht und sich am Rande mit dem schwach ausgebildeten paraplectenchymatischen Hypothecium vereint. Schildchen anfangs ununterbrochen, später stellenweise resorbiert. Ascen in dem Ascomaraume regellos eingebettet, einander eng berühend oder durch eine Masse von undeutlicher fädiger Structur getrennt, oval, 8 sporig.

"*Plectodiscella Piri* WORONICHIN (nov. gen. et spec.) Flecke grünlichweiss, mit braunem Rand, rundlich, 1–2 mm. im Durchmesser, oder oval 4 × 2 mm. sich selten vereinigend, oberseits der Blattspreite. Die Ascomata bilden sich in den Epidermiszellen der lebenden Blätter, später die Cuticula durchbrechend, rundlich oder länglich auf dem Querschnitt des Blattes 75–500 μ breit und 35–145 μ hoch, oft sich vereinigend. Ascen oval, an der Spitze verdickt, meist mit einem sehr kurzen Stiel verschen, 21–23 × 15–19 μ, im Ascoma regellos eingebettet; Sporen 8, meist parallel im Ascus oder unregelmässig liegend, breit spindelförmig, farblos, nach einem Ende mehr verschmälert als zum anderen, am oberen Ende ein wenig abgestumpft, 4 zellig, 12–14 × 4.5 μ. Schildchen (Epithecium) aus vieleckigen oder rundlichen braunen Zellen von 7,5 μ im Durchmesser bestehend, Hypothecium hell gefärbt, dünn, paraplectenchymatisch.

"Auf den lebenden Blättern von Pirus malus L. (cult.), Kaukasus, Gouv. Cernomorsk bei Volkovskaja, 7. Sept. 1912; auf lebenden Blättern von *Pirus malus* L. (cult.) und *P. communis* L. (cult.), Kaukasus, Gouv. Cernomorsk bei Macesta, 28. Aug. 1913, leg. N. WORONICHIN."

It thus appears that the fungus which Osterwalder found occurring in a fruit spot on Jonathan apple in Switzerland is to be referred to as *Plectodiscella Piri* Woronich. Further studies are essential to a more complete knowledge of its range as well as of its economic significance.

The specimens of *Plectodiscella Piri* from Russia and the original culture contributed by Osterwalder have been deposited in the Mycological Herbarium of the U. S. Bureau of Plant Industry.

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NOTES AND BRIEF ARTICLES

Dr. H. S. Jackson, now at Purdue University, has recently accepted a Professorship in Mycology and Cryptogamic Botany at Toronto University, Toronto, Canada, to take effect in 1929. It is expected that the new position will give Dr. Jackson a chance to devote more time to research work on plant rusts. He is already one of the outstanding Uredinologists of America and is to be congratulated on the new appointment and the opportunities afforded thereby. Dr. Jackson has been devoting considerable time to the study of tropical plant rusts and several noteworthy contributions on this subject have been published in MYCOLOGIA.

Part 7, of Volume 1, Die Röhrlinge (Boletaceae) of Die Pilze Mitteleuropas, by Franz Kallenbach, has just appeared. This part contains full discussions, synonymy, detailed notes and citations to literature of *Boletus flavus* (With.) Fr., and *Boletus viscidus* Fr., with three plates containing numerous colored illustrations of various forms and conditions of these species, and detailed drawings of microscopic characters and habitat photographs. The colored illustrations are remarkable for their detail, variety and apparent accuracy. This work is published by Dr. Werner Klinkhardt, Leipzig, Germany. Price 5 Marks per part. C. L. SHEAR.

COKER'S GASTEROMYCETES

The Gasteromycetes of the Northern United States and Canada by Professor W. C. Coker and Assistant Professor J. N. Couch of the University of North Carolina has just been received. Although a number of American mycologists have worked on this group of fungi, this is the first attempt to bring together under one cover a complete record of our knowledge of these forms. Dr. Coker, the senior author, has been a frequent visitor at The New York Botanical Garden, spending most of his time on the mycological collections. He has also worked in most of the other large herbaria of America and Europe and is eminently

fitted for the task which has just been completed. The work which has been published by the North Carolina Press consists of two hundred and one pages of text and one hundred and twenty-three plates made from life size photographs and drawings of the microscopic characters. FRED J. SEAVER.

CULTURES OF SCLEROTIAL FUNGI

During the past fifteen years the writer has been accumulating cultures of sclerotial fungi of all kinds, in connection with his studies on the taxonomy of *Sclerotinia* and *Botrytis*. The total number of strains which we have had in culture to date approximate sixteen hundred. While some of these have died out we still have growing in stock approximately a thousand strains. Under a special grant from the Heckscher Foundation for Research in Cornell University, we are able to maintain these cultures year after year. Many workers throughout the United States and in other parts of the world have, from time to time, made many contributions of specimens and cultures of sclerotial fungi for our use.

We should greatly appreciate it if all workers who may have occasion to collect or isolate sclerotial fungi of any kind would send us cultures or freshly collected specimens, preferably both, whenever they come to hand. We are glad to make any of our cultures available to other workers in so far as is consistent with our obligations to contributors and the progress of our own investigations, believing that in this way we will be rendering service to our colleagues at very little inconvenience to ourselves.

We are particularly anxious to get cultures of any newly described species whether they be of *Botrytis*, *Sclerotinia* or others of the sclerotial fungi. Workers on any of these forms need have no hesitancy in sending such cultures or forms on which they may be working, as we shall be very glad to maintain them in culture under such restrictions as to distribution or use by us in our investigations as the sender desires to make. Full data as to time, host, place of collection, etc., should accompany the sendings.

The writer invites the hearty coöperation of all workers or collectors of these forms in this effort to maintain a large and representative culture collection of sclerotial fungi. H. H. WHETZEL

THE NORTH AMERICAN CUP-FUNGI

(OPERCULATES)

The above work, an advance notice of which appeared in the July–August number of MYCOLOGIA, was issued December 30, 1928. The volume is somewhat larger than predicted, comprising more than two hundred and ninety pages of text and forty-six plates, two of which are in color, the remainder consisting of half-tones and drawings or combinations of both.

Of the two hundred and eighty valid species recognized in this monograph, more than one hundred are illustrated, eighteen of which are in color. Accompanying each species is a complete list of synonyms which, with the diagnosis, represents the author's version of the species, based on the information at present available. In addition to the valid species, notes on a large number of doubtful forms are appended after the genus in which they would appear to belong. For the first time we have brought together under one cover a complete record of our knowledge of the operculate cup-fungi occurring in North America. While the work is essentially North American, the plants of this group are so cosmopolitan that the majority of the forms will be found in almost any other part of the world where we have the same diversity of conditions.

The author wishes here to announce his intention of continuing the study, not only of the operculate forms but of the inoperculate as well, with the hope of publishing a similar volume on the latter or possibly a combination of the two, provided the demand for the present work seems to warrant it. To this end, material and original photographs are solicited from collectors in other parts of the world.

The book is printed on the same grade of paper and in the same general style employed in MYCOLOGIA, and is bound in "Vellum de Luxe" cloth, and is published entirely at the expense of the author. The price of the volume is five dollars plus twenty-five cents for postage and mailing. More detailed information may be obtained by addressing the author at the New York Botanica Garden. FRED J. SEAVER.